Studying Load-Factor as a Guide to Commercial Effort—
The Future of the Lighting Load, Articles on Motor Drive, and the Regular Departments

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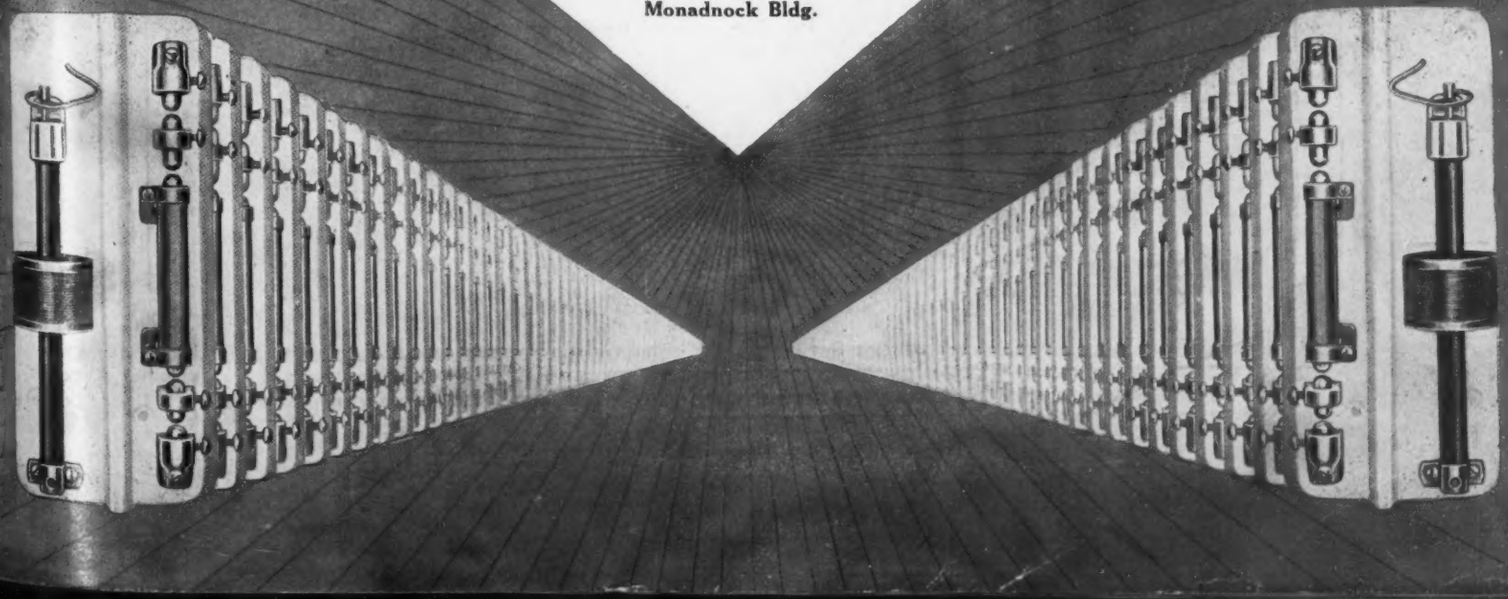

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Thinking Straight on the Electric Vehicle

SUBMERGED in the public mind by wave on wave of publicity for the gas car, the electric vehicle still survives and grows in numbers each year. On another page we quote from a recent meeting of the Electric Vehicle Section of the National Electric Light Association, a group of carefully prepared statistics. To most persons the totals will be surprising. There must be a vital reason for this tenacity of life. The electric started off on the wrong foot as a competitor of the gas car for all purposes. As a result it is still walking through life with blackened eyes. It is not and never can be a competitor of the gas car for speed and distance in the present state of the art of electricity. Until recently speed and distance, without regard to cost and comfort and durability, were the only yardstick by which both pleasure and commercial cars were measured. Now, a change has set in. Pleasure cars are being bought for style and comfort. Car bodies as well as engines are in the public eye. Utility driving as well as touring are weighed in the purchaser's scale. As a consequence the electric pleasure car has each year a wider and more intelligent buying clientele.

Similarly, in the commercial field, business men are thinking not of substituting a motor wagon for a horse but of overhauling their transportation methods. Transportation engineering, in which the vehicle is only one part of the problem of handling goods, is the new calling. With these newer and saner standards of values the electric truck has not only a fair chance, but in many cases much the better of the argument. One cannot ride in an electric taxicab in Detroit and learn that each car is netting something like $3,000 a year to its owners, without being more certain of the electric vehicle's present opportunity. When the president of a great express company says electric trucks are a paying investment, when the sales records of a vehicle company show eighteen cars sold in a small town in one season, when we learn that the great utilities in Chicago and New York are in the midst of plans for constructive local development of their vehicle business we know that our faith in the fundamental values of the electric car for both pleasure and commercial purposes is not misplaced and that the electric is coming into its own. Practice shows that the electric vehicle is best for certain conditions of city work. The transportation engineer who thinks in terms of cost and results has not lost sight of these facts, in the mass of confusing general evidence for supposed gas car superiority. Every central station seeking to widen its commercial business ought to ask car and battery manufacturers how it can take advantage of present conditions now.

The Lucky Power Purchaser

CUSTOM leads us to look at the man who sells as a doer of great things. It is this man who tells with pride how he has closed a contract for a goodly quantity of power. With the mere buyer we have no concern. He was only the molded clay in the hands of the skillful salesman. The deal was made, not because the buyer cleverly drew the seller into his meshes, but because the trained salesman made out a case for his product which was so logical that the consumer had no alternative but to write his name on the dotted line. But when conditions change and the seller finds that the buyer has a shade the best of the arrangement his respect for the buyer rises. And it is the turn of the buyer to pat himself on the back for his extraordinary foresight.

This illustration tells the story of what has been happening in the case of some central station contracts for stand-by service to owners of isolated plants. Coal shortage is throwing the burden of the requirements of the isolated plant owner upon the busy central station. Added to record-breaking demands from regular consumers the extra calls for service are a serious tax upon capacity. The shoe is on the foot of the man who has a long-time low-rate contract for the purchase of power.

Standards of Public Policy for the N. E. L. A.

THE public policy committee of the National Electric Light Association has put before the representative membership of that organization an epoch-marking plan for enlarging its work. It is not the plan of novices. It is the careful, deliberate result of a systematic survey of the conditions before the central station industry. It promises large returns. With its execution the association will wield a powerful influence in the fair settlement of public policy questions. In the past it has settled many problems, it has led many companies. In the future extensive organization, abundant funds and the sense of greater responsibility will fit it to do much more.

In considering the importance of the new work, members will do well to recall that the committee foresightedly indorsed regulation when that policy was in its infancy. In other respects, too, it has led development. Accustomed to looking ahead, the committee decides that the time is ripe for continuing on a much greater scale, for continuing intensively the shaping of broad policies. The commercial central station industry cannot afford to disregard the questions of the committee. Only the skeleton of its idea is presented in the letter to members; perhaps this is all that could be said until the plans are carried further. But it is not neces-

sary to read far between the lines to understand that the vital topics are on the list. Data on commission rulings, valuation terminology, methods in valuation, rate-making and rate-data, municipal ownership and operation, water power regulation and legislation, regulations on inductive interference in transmission lines are only the announced subjects. That the committee will, as it indicates, find other matters to occupy its attion is certain.

Larger work and income mean larger responsibility. In taking up duties that potentially have the greatest possibilities for the commercial central station industry the committee will not seek to evade the accompanying responsibilities. Holding these responsibilities before it, the N. E. L. A. should be able to form virtual standards of public policy. If it can show a company that its rates are above the line of fairness, that it is foolishly or needlessly antagonizing the public, that in running counter to public opinion it is endangering its position as a "beneficent monopoly" the association will clear up situations which jeopardize the industry. And at other times its proper function will be to combat unjust public demands. Information, research, is the basis of the proposed work. Action will follow. The plan has in it so much that is of promise and value that its hearty indorsement and support by the membership are to be expected. There certainly is need for constructive work in the directions indicated.

Iron Wire Transmission Lines

THE enormous price of copper has put a heavy burden on power transmission circuits, even those on which the load is comparatively dense. When it comes to extended networks carrying relatively light loads the cost of conductor has become outrageously and forbiddingly high. We have published data from time to time on the use of iron wire as a substitute for costly copper, a subject which came to the front in Germany very soon after the outbreak of the war and was considerably discussed. The transmission line which M. D. Leslie described in a recent issue is of particular interest as being rather the most extensive as yet tried, at least in this country. The situation is one common enough on transmission lines, namely, the desire to supply small towns with the necessary light and power from an existing network. To do this on a sound economic basis demands a low investment, and with copper at the rate of 40 cents a pound or thereabouts something radical had to be done. The distance to be covered was about 30 miles and the total load which could be reasonably expected in the two communities reached only 75 kw., barely two-thirds of this being touched by the present peak. The solution of the economic problem was found in using a three-phase circuit of No. 6 galvanized iron wires carried on steel poles set in concrete with a span of 300 ft. The voltage of transmission is 22,000.

The great tensile strength of high-grade iron wire enabling the use of long spans is a very important feature of its utility and the use of steel poles gives a substantial and permanent line free from risk of fire and with relatively little danger from lightning. It is rather interesting to note that the steel poles used were actually of less strength against a pull at the top than the wooden poles customarily used, but yet were amply strong to meet all the requirements with a suitable factor of safety. The result is a strong and reliable line at very modest cost, indeed, enabling service to be rendered to communities which would otherwise have to be without it at least until the price of copper resumes its normal course.

The regulation of this iron wire transmission line, as Mr. Leslie has indicated, has to be watched somewhat carefully, and for heavy varying loads would undoubtedly prove inconvenient. Iron can hardly be considered a general substitute for copper as a conductor, yet its low cost in construction may often, as in the case before us, quite overcome the minor operative disadvantages attending its use. Three months' service on this line have shown only two cases of failure due to defects in the wire, which is doing very well considering the length of circuit. If the price of copper keeps up some little time, as now seems very probable, a good many branch lines are likely to be constructed of iron.

For anything save very small amounts of energy stranded wire will undoubtedly be used, and when properly put up should give a very cheap and reliable system, even in cases involving considerably more energy than that handled in the case mentioned. With a substation equipment automatic regulation of the terminal voltage is entirely feasible, so that with reasonable judgment in design and installation there seems to be no reason whatever why iron may not be employed on a considerable scale between the limiting variations of operation and service that have been outlined.

Selling Aluminum at a Profit

CENTRAL stations are not trading companies; if they merchandise household appliances they do it as only an incident in their larger function. They do not build up elaborate physical equipment in order to dismantle it part by part, to sell as there is opportunity. Even if they get a tempting offer they prefer to keep apparatus until the end of its usefulness for their operations. But times and unprecedented situations alter policies in this as well as in other directions. The high price of aluminum offers a profit which arouses the trading instinct. A company which has aluminum transmission line is not justified in overlooking the chance to scrap it and to substitute copper. It has a commercial interest in analyzing the comparative value of the two metals. Several properties have made substantial profits by dismantling aluminum lines, which after all were not giving the service expected, and reverting to the red metal. The example which is described elsewhere in this issue is but one of several conspicuous instances which have been reported in the historic thirty months just past.

The Analysis of Load

THE unattainable ideal of every central station is the 100 per cent load factor stretching uniformly through the twenty-four hours without peaks and without hollows. The nearest point to its realization could perhaps be reached by a plant dealing with some electrochemical industries, but in general service no such good fortune could be expected. Mr. Leffler in a most instructive paper indicates some of the methods which may be applied to the analysis of load growth to ascertain its commercial desirability. Obviously an added load which is piled upon the peak cannot be assured of a warm welcome from the central station, while if it is devoted to filling up a conspicuous hollow in the existing load curve it is greeted like a long-lost brother. A chart showing merely the increase of load from year to year conveys only a very imperfect idea as to what is actually happening in the business considered as a paying enterprise.

Mr. Leffler in his article very properly divides the growth of load into two separate factors: first, the natural increase which comes from the ordinary process of a growth in the community and the appreciation of advantages of electrical service; and second, the artificial growth stimulated by careful salesmanship which is devoted to new uses for electrical energy and to building up service which will tend to improve the load factor, and hence lower the cost of production and ultimately render lower prices feasible. It is this controlable artificial growth of load which is the most important factor in station economics and it is from the summation of the various items which go to make up this factor of load that the greatest information of economic value can be obtained.

For instance, Mr. Leffler's curves show that the normal growth of load differs very little in its character from year to year as regards the distribution throughout the twenty-four hours. In the territory in which his studies were carried on the normal peak during the period investigated is at about 6 p. m. and it is clearly shown that the natural growth of load does not shift the peak appreciably from this period and hence does not improve to any sensible degree the load factor. There is always a period of considerable growth in the morning at just about the time when the industrial load comes on with the effect of rather exaggerating the variations of load than diminishing them. Following the same subject a little further it is found for the particular territory investigated that the electric range load corresponds so closely to the conditions of normal growth that it adds seriously to the peaks already formed, a condition which certainly does not exist in some other localities. On the contrary, the effort made to develop the water heating load, quite negligible in most central stations, tends to call for energy at a later period than the range load proper and hence to improve the load factor by increasing the off-peak consumption. The same would doubtless be true of ordinary electric heating which offers considerable possibilities in moderate climates.

Now each class of service considered involves a different ratio of service expense to receipts, so that the mere summation of increase in load tells very little about the net results to the station. The subdivision of the increase into its separate factors, however, gives opportunity for testing the relation of each class of service to gross and net profits. It is only by such analysis that it becomes possible to direct the selling efforts of the supply company's force so as to produce the most efficient results. If a salesman's efforts are aimed merely at getting as many kilowatts connected as possible, he may be doing admirable service to his company, or he may actually be depleting its treasury. This is a point not often appreciated by the solicitors of central station companies and very frequently lost sight of by managers in charge of properties.

The most skillful kind of team work is necessary in developing load for maximum results, and the organization of this work demands just this sort of intimate analysis that Mr. Leffler here explains. All this has a very direct bearing on the relations between the supply companies and the public service commissions with which they almost universally have to deal. Before the commissions can get any adequate idea of the real commercial status of the companies, over whose fortunes they have large powers, they must be brought to understand the relation between the various classes of service undertaken and the profits that accrue therefrom. Mere increase of output, however impressive the showing of proportionate growth may be, does not imply large reductions in the cost of service and may indeed connote upon an ever-decreasing scale of profits. The equities of the situation demand that keen attention shall be paid not to the growth of the load alone, but to the discordant items which go to make up this growth.

The Coming Issues

AS usual the next issue of the ELECTRICAL WORLD will be devoted to matters of public policy and the broader phase of problems in the management of public service properties. In the second issue of next month, dated March 10, a leading article will discuss the nature of sleet troubles on transmission lines and methods used to prevent these troubles as developed by the Pennsylvania Water & Power Company. Other engineering articles of that number will take up particularly station and operating problems. In the third issue of March, another section of Prof. Alfred Still's article started in the Feb. 17 issue bearing the title of "Insulation of High Voltage Transformers" will be presented. The issue dated March 24 will as usual take up commercial problems and phases of central station commercial business. In the fifth issue of March a leading article will deal with the electrical layout and operating features of a large New England cotton mill. Other articles in this number will discuss engineering features of industrial installations and their operating problems. ELECTRICAL MERCHANDISING for March will be issued on the 15th of the month and feature selling plans and methods of timely interest.

The Possibilities of the Lighting Load

How Increases in Lamp Efficiency May Serve to Retain and to Materially Strengthen the Present Position of Lighting as the Major Producer Among Central Station Services

BY WILLIAM A. DURGIN

THE prophecy that electric lighting is doomed to continually decreasing importance has gained some considerable acceptance during the last few years among central station men. Prominent executives have referred to lighting sometimes as a future by-product. Certain sales managers have given this portion of the business merely perfunctory attention, and lighting salesmen have felt that their effort at best could gain recognition only as a routine contribution to income.

Assuming for the moment that lighting is in grave danger, should we not all the more concentrate our attention upon means for strengthening its position? Is not this the time to reanalyze the entire question; to get a clear view of the reasons for the failure of interest among the salesmen; to investigate the possibilities of revivifying the enthusiasm which formed such a large factor in the tremendous electric lighting advance during the last decades of the nineteenth century?

INCREASES IN EFFICIENCY

The greatest influence toward the central station attitude, of course, has been the enormous increase in the efficiency of light production, achieved by the graphitized, and vacuum-tungsten and gas-filled tungsten lamps. With a viewpoint founded on the older carbon incandescent lamp, with an organization developed to handle the rather expensive light which it produced, even the increase from 3.1 to 2.5 watts per candle, as realized in the graphitized lamp caused some central station managers to question the future. To many, 25 per cent increase in efficiency meant only 25 per cent decrease in the amount of electricity consumed. But when this advance was quickly followed by the vacuum tungsten, two and one-half times as efficient as the carbon, the case became critical.

To be sure, the development produced a wonderful selling argument. "Nearly three times the same amount of light for the same money" could be used to retain some of the business. Still it was predicted that many customers would decide that two and one-half times the original lighting was altogether too much. Far worse, many lighting men, educated in the practice of 3.1-watt lighting, fully believed that a watt-for-watt replacement with the new lamps was excessive. Curves similar to that shown in Fig. 1 were used to some extent to impress the increased purchasing power of the dollar, but most central station men saw in imagination the inverse curve, as in Fig. 2. In place of the optimistic rise of the selling curve they dwelt upon consumption dropping rapidly and when the gas-filled tungsten, with five or six times the carbon lamp's light output appeared, the falling curve seemed to approach zero.

There is no disputing the fact of decreased consumption. The gas-filled lamps, even in the small 100-watt size, consume but 25 per cent as much electricity for a given light output as did the 3.1-watt carbon lamps. If lighting practice during the carbon period was more than in the first stages of development, if the prevailing assumption that lighting installations were satisfactory with the older lamps is even approximately true, there seems little hope of striking achievement in the lighting field. It is the purpose of these articles, however, to show that such assumptions are fundamentally wrong, that the older artificial lighting was the merest makeshift and that the development in incandescent lamps, properly interpreted, opens a future for lighting which may well enable it not only to retain but to materially strengthen its present position of major producer among central station services.

OVER-EMPHASIS ON POWER BUSINESS

The pronounced tendency to consider lighting application as already standardized and hence as possessing a most restricted field for the man of originality and initiative, has added weight to the over-emphasis on power applications. The possibilities in power have been so large. Electrification of steam roads, enlargement of electrochemical industries, adaptation of individual motor drive to an almost infinite number of machines, present opportunity for all grades of ingenuity. Power contracts, too, generally represent a sizable increment of income from a single transaction. On a commission basis this adds considerably to the salesman's interest.

At the same time these large increments impress executives, both because of increased return and on account of the apparently simple changes in the transmission, accounting and supervision systems sufficing to care properly for the new business. Power has been so much more spectacular than lighting that it has gained prominence at the expense of the older portion of the business and to many it has seemed to promise income several times that which could ever be secured from lighting alone.

THE PUBLIC-RELATIONS VALUE OF LIGHTING BUSINESS

It must not be forgotten, however, that electric lighting is of primary importance quite irrespective of the income resulting. All public service companies depend largely upon the good-will of their community, and this good-will is secured, naturally, through common interest. With all the concentration of the best thought and ability which has been directed toward power, a comparatively small percentage of the total customers of any central station use it. For example, the Commonwealth Edison Company of Chicago, is particularly fortunate in its power business, yet 88 per cent of the consumers know it only as a lighting company and this percentage has increased steadily during the last ten years. Some, of course, use small utensils, but these were added in most cases to an already existing lighting installation and although the utensils are gaining the company many friends, lighting is still the primary bond with the greater portion of the public.

As J. W. Lieb of the New York Edison Company has said: "The incandescent lamp is the principal translating device with which the customer comes into contact and by far the most appealing, revealing as it does at once visually and forcibly any defects as well as the excellences of the service. It is more generally used than any other appliance, and its service being a more prominent and observed feature it commands more attention and consideration from the public than do all other devices combined."

Among our senses the eye stands pre-eminent, especially in modern life, dependent so largely upon

printed matter. Color and form are coming more and more to dominate our amusements. The portion of life spent under artificial lighting is steadily increasing. For a public service company, with the possibility of municipal ownership always lurking, can we overestimate the importance of that portion of the output through which nine-tenths of our customers are made our friends or our enemies; through which the most vital sense of the public at large is pleasantly stimulated to satisfying activity or strained to early exhaustion?

LIGHTING AS AN INCOME PRODUCER

These arguments alone should be more than sufficient to regain attention for lighting, but such aspects seem almost insignificant when a careful analysis is made of the actual present position of lighting as an income producer. For despite the tremendous decrease in the consumption of individual lamps, despite the lessening attention given to the lighting business, the returns from lighting have shown a continual increase. The consumers, the actual users of light, have developed an attitude toward its benefits much more appreciative than the most optimistic lighting men could hope. The improvement secured by a moderate increase of lighting once seen, the larger number of customers have demanded yet more light. The notable growth of our industries has aided in the increase. More efficient light generation has led also to its application in many locations which would not have been considered with the older lamps.

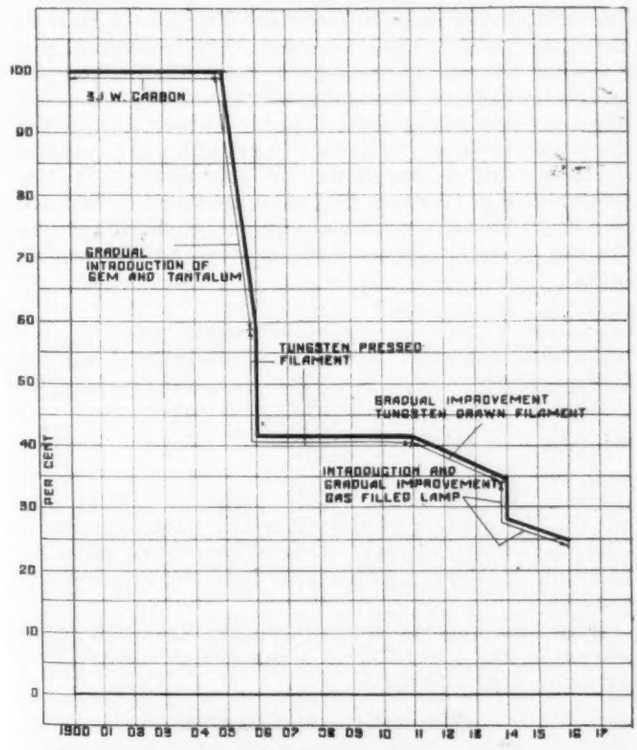
Practically all of this lighting business has been taken on at regular rates. The allowances for off-peak use, for high load factor and for large bulk, which have lowered power rates, rarely apply in lighting and as a consequence the gross income from this business has been and is still a major portion of the total. The power enthusiast still insists, of course, upon attention to net income only, and here he has a somewhat better case. It is believed, however, that an unprejudiced consideration of all expenses in any central station business will materially lessen the burden of plant investment, service costs and overhead previously allotted to lighting and that the importance of lighting once admitted, many of the power rates, in reanalysis, will be seen to be too low, leading sometimes to actual loss. In other words, the prejudice in favor of power has been so extended that frequently lighting has been charged with excessive expense.

STABILITY OF LIGHTING BUSINESS

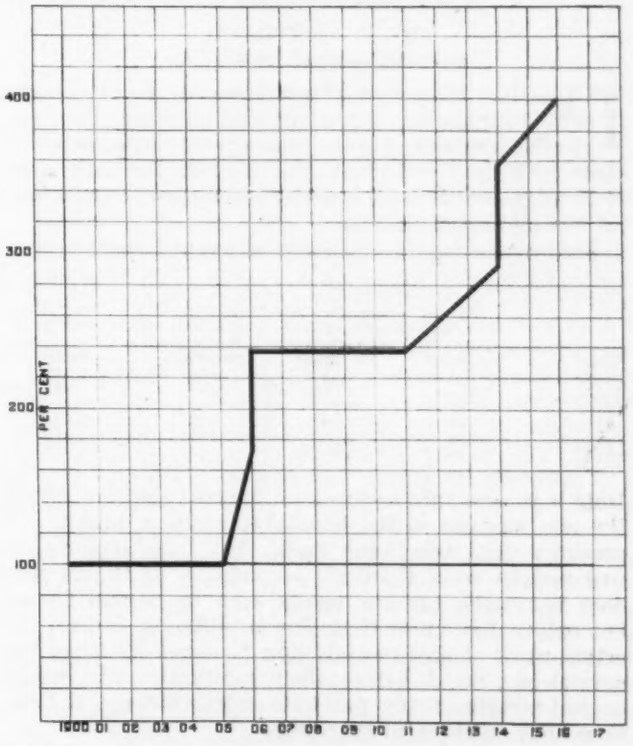
After all fair revisions are made, however, it must be conceded that lighting is more costly to deliver in small quantities than is power in large blocks. The relation of net lighting income to expense can never be as generous as for power, but as long as profit is reasonable, lighting remains most attractive and the value of its predominant gross income is fundamental.

From the standpoint of stability of revenue the arguments in favor of lighting seem final. The return from many power applications depends entirely upon the trend of business. Electrochemical industries, for example, are subject now to abnormally early obsolescence of apparatus and processes. Many industrial undertakings supply a single phase of demand. The very size of the individual power consumers, too, suggests instability, as so much is lost by one failure, and line extensions which figured very low per kilowatt connected, become alarmingly expensive with no load remaining. These considerations apply to lighting to a very much lesser degree. The load is so distributed throughout the community that adverse conditions in one industry affect it slightly. Even in hard times the modern man feels that he must prolong his day, whether in business or at home, well into the hours of darkness and lighting output is reduced but little comparatively by quite extreme depression.

Such factors, it will be noted, are of weight irrespective of increased efficiency of light generation. These form the firm foundation for any development of the business. To this well founded industry now comes the possibility of tremendous enlargement.



ENERGY CONSUMPTION PER CANDLE-POWER OF MEDIUM-SIZED LAMPS IN PER CENT OF ENERGY CONSUMPTION OF 16-CP. CARBON LAMP



LIGHT GENERATED PER UNIT COST OF ELECTRICITY USING MEDIUM-SIZED LAMPS, IN PER CENT OF THAT FOR 16-CP. CARBON LAMP

Light production at five or six times the old efficiency requires an entirely new conception of the possibilities. The older light was something of a luxury. Admittedly, in comparison with former illuminants it was expensive. In consequence electric lighting men in general found themselves obliged to accept as satisfactory the lowest intensity which made seeing at all possible. Higher intensities than this led to excessive cost, dissatified customers and restricted business.

As a necessary corrolary lamps were installed to light a small working space, leaving portions of the room dim and nearly useless. With such installations it was most difficult to protect the eyes of users, and glare has been so common that most people have come to believe that artificial lighting is inevitably a serious strain to the eyes. The light from these older lamps, too, was so costly that it was necessary to use every iota and the color which happened to be generated was accepted without any attempt at filtering. This appeared vital to the general adoption of electric lighting and extended arguments were prepared in the attempt to show that under all circumstances this haphazard color of light was the ideal!

To-day we are dealing no longer with a luxurious commodity. Electric light from the gas-filled lamp is a cheap raw product. In many cities rates are so low that seven times as much light is secured as could be obtained for the same cost ten years ago. We can afford to refine this raw light and throw away adulterating or harmful ingredients in order to improve the economic value of the remainder. We can afford to apply it in quantities hitherto never considered possible, approaching even daylight intensities, and we can afford to install those accessories which give the most effective use, even though the bare physical efficiency is somewhat lower than in the older glaring arrangements.

Artificial lighting is just entering upon an entirely new era, an era of the greatest promise to the user, an era which may be made most profitable to the central station. In succeeding articles it is proposed to amplify three lines of lighting advance, offering an increased load to the service company but giving the customer economic advantage far in excess of increased consumption. These three lines are:

1. The use of enough light.
2. The general installation of proper lighting equipment.
3. The application of "filtered flux."

European Markets for Electrical Products

Conditions in Italy and Russia After the War Will Invite American Manufacturers and Jobbers—Preparations to Be Made

Articles published below give information which is of interest to manufacturers and jobbers who will sell electrical apparatus and supplies in Italy and Russia after the war. Both countries offer large opportunities for American products.

ITALY OFFERS MARKETS FOR OUR MANUFACTURERS

BY F. CASTIGLIONI
Electrical Engineer, Milan, Italy

I GLADLY accept your invitation to write a brief article explaining conditions and showing American electrical manufacturers what opportunities exist for them in Italy, for I think that benefits for both countries might result from a better knowledge of these conditions and opportunities.

Before treating the question of applied electricity in Italy it is necessary to touch on the coal question, which the war has put in the limelight in all its gravity. I presume that Americans know that Italy imports its coal mainly from England, a condition of things that does not make for low prices even in normal times; but only a few know that, due to different causes, the actual price of coal in Italy now is about six times the normal one, which brings about a situation that would be unbearable if the patriotic spirit did not dispose everybody to cheerful sacrifices.

To see coal at its former prices is scarcely to be expected, and the remarkable industrial development of modern Italy would be irreparably hampered in its imposing program of future progress if there were not the possibility that an aggressive policy of hydroelectric development will save the situation.

Italy is not only an agricultural land, as some appear to think, otherwise the field of applied electricity would not show the imposing total of over 1,000,000 electrically generated kilowatts. For the immediate future its policy, dictated by sheer necessity, has to be the following: To harness without delay all of the waterfalls of the country and through electrical distribution to make available the 3,000,000 kw. that they represent, thus reducing the yearly import of more than 10,000,000 metric tons of coal and at the same time offering a surplus of cheap power for a greater industrialization of the land, to realize the great project of general railroad electrification, to encourage the introduction of electric ovens and furnaces for metallurgy and the production of fertilizers for agriculture, and finally to increase the use of electricity for light, power and also heating purposes in the home. This program will at once awaken the interest of the American manufacturers of electrical goods. Import figures which are tabulated herewith in metric tons per year show the extent of the progress.

	Motors, Generators and Their Parts			Carbons for Electrodes, Brushes, Lamps, etc.			Apparatus—All Kinds		
Years	Total Imported	Imports from Germany	Imports from America	Total	German	American	Total	German	American
1908	8,744	6,154	556	1,565	1,315	...	480	269	80
1909	7,118	4,591	440	1,309	822	...	618	265	75
1910	6,595	4,271	249	1,384	762	...	878	285	89
1911	5,954	4,231	143	1,532	838	171	1,098	595	56
1912	5,286	3,686	109	1,983	1,107	140	1,154	564	36
1913	4,150	3,704	94	1,799	1,095	122	1,221	944	90

Italy also imports annually about 10,000,000 incandescent lamps, and of these about two-thirds are from Germany and Austria.

ITALIAN OUTPUT LARGER

Statistics concerning the Italian output are rather difficult to obtain, but it will suffice to say that it is

progressing at a rapid rate, especially for machinery up to medium size and for the most widely used types of apparatus and instruments. It is scarcely to be believed that the home industry will follow the accelerated rate of development imposed by the circumstances.

The tabulation published herewith shows that the bulk of the Italian imports was from Germany, while the United States has a very low percentage. It is not a matter of conjecture to affirm that after this war German goods will not find an easy way to Italian customers through the future custom barriers, and therefore it is up to the American exporter to find his way to replace the German products. Moreover, if one takes the trouble to consider the American export figures by themselves, he will find that as to electrical goods Italy has about 3 per cent of the total, a very low percentage in comparison with the importance of this market, even making due allowance for the distance and the hard competition.

How could the American industry gain its due share in the Italian electrical market?

I am not speaking to my good friends with the great manufacturing companies, for these companies already have their branch offices and factories in Italy, and will know how to take advantage of the next great revival. My only remark for them would be that in Italy there is a good market also for large machinery and apparatus of their standard types, but built on Italian soil and by Italian hands. Moreover, these branch factories ought to extend directly from the main house and be considered as something more than repair shops.

Extending Credit Facilities

To the many other American manufacturers in this line who are not yet in commercial connection with Italy, I would suggest that they consider the importance of this market, principally for special and novel apparatus, for heat for all electrical uses, for lamps, etc. It is not necessary for them to start at once planning a branch office or shop. A good start would be to make arrangements granting some firm selling rights; that alone can justify the trouble and expense of introducing a new brand. When people show the right kind of guarantees and references, the first rule has to be to extend to them the necessary credit, because to stipulate "cash payment against shipping documents" sounds at least funny all over the world, which on the average is not overburdened with riches. It was one of the easy German secrets, that of accepting the commercial usages of the different places, extending all possible credit facilities, and nobody could deny that this method brought commercial success.

There are already a branch of the Bencodi Napoli in New York and one of the National City Bank of New York in Genoa, and others will probably follow, so that all possible information can be had, and sure but reasonable credit arrangements can be agreed upon. There is a good field in Italy for American capital to finance good electrical enterprises, as others have done with profit.

There are many other questions connected with exports, each of which has its importance. For instance, it is advisable, though not necessary, to quote the values, weights and measures of the customer, and possibly c.i.f. his nearest harbor. The buyer would find it difficult to know how many francs the cubic meter of a certain wood would cost c.i.f. Genoa if the quotation was in dollars per cord at St. Paul, and I know some American exporters who overlook all of this.

As to quality according to the samples, careful packing, right terms of delivery, etc., I have too high an esteem of the American manufacturer to hazard any advice.

PREPARATION NEEDED FOR RUSSIAN TRADE

By Sterling H. Bunnell
Chief Engineer R. Martens & Company, New York

At this time, when trans-oceanic traffic is closely limited to the munition requirements of the armies of the warring nations, manufacturers are looking ahead in preparation for export trade in other lines. Current statistics from every European country show the diversion of labor from all other work to the munition factories. The reality of this distortion of production from normal lines can be seen in a day's journey in Canada, where shells are being made in increasing numbers by corporations which are unable to turn out more than a fraction of their usual products. There is not the slightest doubt that extraordinary wear and tear has gone on in all mechanical equipment in the countries at war. Replacements and repairs, to say nothing of extensions, will cause a brisk demand for imported articles in all of those countries.

Unless better and direct connections are provided by American manufacturers now, the export business which follows the war must come through the old, inadequate channels of small export agencies in the foreign countries that have correspondents in America. The names which are familiar to us here are unknown abroad. How many manufacturers in Russia, for instance, have copies of Hendricks's, Thomas's or Sweet's classified lists of manufacturers? How can a Russian house place an order for electric generators, transformers or telephone material of American manufacture, not knowing the names of any of the makers who are so familiar to the readers of this article? And if the names were ascertained by some English-reading member of the organization from an American trade journal, how shall the customary f.o.b. price of the equipment at an American inland shipping point be compared with the delivered and erected price which English, French and German concerns will quote through their local representatives in Russia? Personal contact with the buyer is absolutely necessary for any house that is to compete successfully for business in a foreign country.

Different Ideas and Tastes

The ideas and tastes of those who live in foreign countries are quite different from our own. To do a successful export business it is necessary to become thoroughly familiar with those ideas and tastes. Having become so familiar, it will be possible for the manufacturer to decide whether to make what the foreigner now wants, or to create a demand for the manufactured goods as they are. Often a middle course can be adopted, and the regular products modified somewhat sufficiently to fill the existing demand. But if any course short of copying the articles already on sale in the foreign country is to be adopted, it is very important to have the most accurate knowledge of the purchaser and his fancies. It is not easy for an American counter salesman to determine why his American customer refuses one thing offered and selects another. It is infinitely more difficult to determine what the foreign purchaser will like and buy and what he will leave alone. The investigating traveler ought to be a native and resident of the country which he is studying and familiar to the last degree with the manners, customs and tastes of its people.

If it is decided to go about creating a demand for something new in the country in which it is to be sold, the way in which the article is presented is all-important. We like our own style of advertising matter, with its features of language, illustration and printing. Nothing just like it is found in any foreign country.

The publicity man therefore meets a problem at the very beginning of his work. Will the foreign buyer be most attracted by printed matter on the exact lines conventional in his country, or by American-style printing? Americans, for instance, do not generally fancy the appearance of catalogs printed in England; it is probable that the English do not care particularly for catalogs as they are usually printed in the United States. The force of convention is so strong that sales literature, to have pulling power, must be so nearly in accord with what the reader has been accustomed to expect that he will not be repelled by its form or tone.

American Catalogs Not Suited for Use in Foreign Countries

Most American catalogs are not suited for translation and use in foreign countries. The subject matter is too technical; it goes too deeply into theories of design and construction, and it describes manufacture by special processes, the use of special materials, and other scientific technicalities that interest only engineers and expert constructors. The foreign buyer wants to know what the article will do, and how much better it is in use than competing articles, rather than how it is made. If it is something new to him, he wants to know what it is and how it works. In every case he wants sizes, weights, *cubic measurements*, and prices, and all in his own units of measurements, weight and money.

Illustrations of machinery are most useful in making foreign sales, but they should show the machine set up for operation, not set up for mere show. The operator, if shown in the picture, gives a correct idea of the size and proportions of the machine. The name, size number and description of the machine should appear as a caption. Each picture should be correct in every detail, so that the buyer may know just what he is getting. The background and accessories should be either a scene in the foreign country, so that the machine will appear in familiar surroundings, or else should show unmistakably its use in the country of its manufacture.

When, after preliminary work, inquiries from prospective purchasers begin to arrive, they must be handled in a different manner from domestic inquiries. Information from a foreign prospect is never complete, and yet it must be used in making up a complete reply. Imagination is needed in answering foreign inquiries. If, after an interval of two months or more, the foreign correspondent receives in reply only a catalog and a list of questions from America, he will naturally close with the English or German house whose prices and alternatives have been in hand for a month. If vitally necessary details must be had, they should be cabled for instantly on receiving the inquiry; the fact of cabling, showing the interest of the American, will help to hold the matter open for him. But it is better to assume the conditions and to estimate in several possible ways, writing fully the advantages of each. The inquirer may have no means of deciding on even the fundamentals until the letter arrives.

A Chance for Imagination

For illustration, consider an actual inquiry which was received recently for "all materials for an electric tramway, poles, rails, cars, etc., except power plant, which will be purchased in England." The usual routine sales correspondent in America would throw up his hands, and write or mail a printed list of questions asking gage, weight of rail, voltage of current, and a hundred more questions, none of which could possibly be answered by the foreign promoter, who evidently plans to install a system in some small city and must decide how much capital is needed. A man with imagination will assume everything from voltage to size of cars, write a ten-page letter if necessary, giving present approximate prices, and send illustrations and catalog pages of the articles he mentions. The promoter may have to come back with his details, but the seller has gained for himself an inside hold on the proposition which will be difficult for any competitor to overcome.

Importance of Personal Investigation

Personal investigation of the conditions in a foreign country is of great value to the manufacturer who is planning for export trade; but even more important is the establishment of export service facilities, including banking, shipping and delivering arrangements, so that goods may be quoted to the buyer at his own works and on his own terms of payment. The total amount of the transactions which require the services of an exporting organization is astonishingly great. Only corporations of great resources can carry out the larger projects which will be ready for American manufacturers when peace is declared. Connection with a strong exporting corporation is absolutely necessary for the manufacturer who is not in a position to make large investments abroad and desires to keep his working capital active in his own factory. There is plenty of work for able salesmen in connection with the activities of the exporting house.

Whether the salesmen working in the interests of a particular manufacturer receive their compensation from him or from the exporting house is a matter of mere detail. The cost of their services must be paid out of the profits of the foreign sales. It makes no difference at all whether the necessary percentage for maintaining the salesmen is provided out of the manufacturer's gross profit, or out of an increased commission (or profit in the final selling price) of the exporter.

Foreign trade is going to be a large item in the future prosperity of American manufacturers. The wise manager will make his foreign connections now, and with the aid of a responsible and capable exporting corporation will study the possibilities of foreign business and get the necessary information in time to be ahead of the competition which is sure to come when the war trade barriers are down.

Hartford, Pioneer City in Battery Service for Trucks, Now Has in Operation 400 Electric Passenger Cars

Although Hartford, Conn., is a pioneer city in battery service for trucks, some 400 pleasure cars of the electric type are now in operation, and the popularity of these machines is rapidly increasing. Four prominent makes of electrics are exhibiting this week at the Hartford Automobile Show, and one dealer informed a representative of the ELECTRICAL WORLD that one new car a week of his type is being purchased, apart from the sales of competitors. Electric garage service at a flat rate of $35 per month for each pleasure car stabled is rapidly developing, and a garage with seventy-five cars in its care will shortly move into new quarters capable of accommodating probably 300 electrics. At the Hartford Automobile Show the pleasure electrics were located close together, giving a cumulative effect which was well worth while, and in finish and appointments these cars compared well with the best gasoline-driven motor cars. Lower prices for closed electrics are bearing fruit in increased orders. "Hartford is the best electric pleasure car city in proportion to its size east of Buffalo," said one representative at the show, and the multiplying of these units on the local streets bears out the truth of the remark.

Analyzing Growth of Central-Station Load

Studying Past Progress and Load-Factor Conditions as a Guide to Effective Future Commercial Effort for Load-Curve Improvement

BY W. S. LEFFLER
San Francisco, Cal.

IN the annual report of the central station company the popular form of "step" chart, with each step a year and their proportionate heights indicating annual growth, serves admirably to convey to the technically disinterested stockholder the fact that some consumers were added. Perhaps a chart like Fig. 1 may further aid, if the scales are properly chosen, in showing that the load also grew.

But the step chart does not discriminate between the 2000-kw. twenty-four-hour pumping consumer and the dollar-a-month, move-six-times-a-year domestic fly-by-night, nor does an analysis such as Fig. 1 indicate the good and bad load characteristics of the connected load which the past year's effort has placed upon the lines. That is, such a chart as Fig. 1 does not discriminate between quantity and quality growth, and a study of it does not indicate the danger points or unbalances that may be creeping into the growth due to the commercial effort being concentrated upon a particular class of service whose peaks may be adding to the peaks already occurring in the normal growth.

To the central station operator and executive the

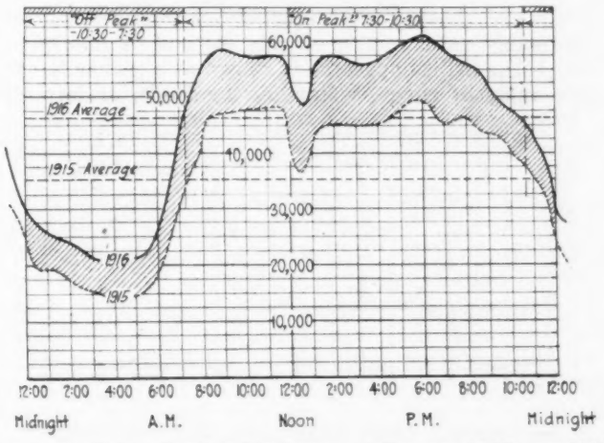


FIG. 1—AVERAGE OF DECEMBER LOAD CURVES FOR 1915 AND 1916 SHOWING, BY SHADED AREA, GROWTH OF LOAD FOR EACH HOUR OF THE DAY

popular analyses do not express a definite relation between load increase, the cost of that load increase, and the nature of the commercial effort necessary to most effectively counter the unbalances which, unwatched, finally grow into serious peaks. Hence the presentation of this method, which is based upon facts which are self-evident.

It will be immediately conceded that all central station growth is the result of one of two agencies: First, the natural increase of load resulting from the business which comes unsolicited due to the *natural* increase in population, general education, and the relative progressiveness of the community, which kind of growth, for the purpose of this discussion, we will call the "natural growth."

The second and only other agency producing central station increases is the active solicitation and aggressive campaigning which is carried on by and at the expense of the central station and its allied commercial organizations. The growth produced by this commercial effort we may call the "made load."

It is equally apparent that the business which comes unsolicited would have certain definite load characteristics, depending upon the dominant feature of the greatest part of the central station's custom. The peaks of the load curve of the "natural growth" might or might not coincide with the station peak, but since each year's "natural growth" is but an increment of the total station

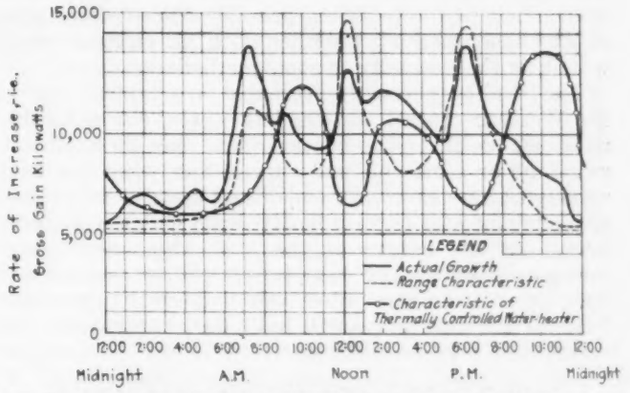


FIG. 2—CURVE OF ACTUAL GROWTH IN LOAD FOR EACH HOUR OF DAY, COMPARED WITH HOURLY LOAD CHARACTERISTICS OF ELECTRIC-RANGES AND WATER HEATING CUSTOMERS

business and load, it is reasonable to assume that the peaks of the natural unsolicited growth *will* coincide with the system peak already formed. Further, with respect to this natural growth, since it is unsolicited it is at once evident that the nature of its collective load characteristics and its relation to and effect upon the established peaks cannot be controlled by any power within the central station's reach other than discriminatory rates, which means is indeed a thing of the past.

THE CONTROLLABLE "MADE GROWTH"

On the other hand, the load characteristics of the "made" growth, coming by solicitation and aggressive development work, can be controlled, and the location of its peaks placed at nearly any hour of the active day by concentrating the commercial effort and expense upon the development of those classes of new business load

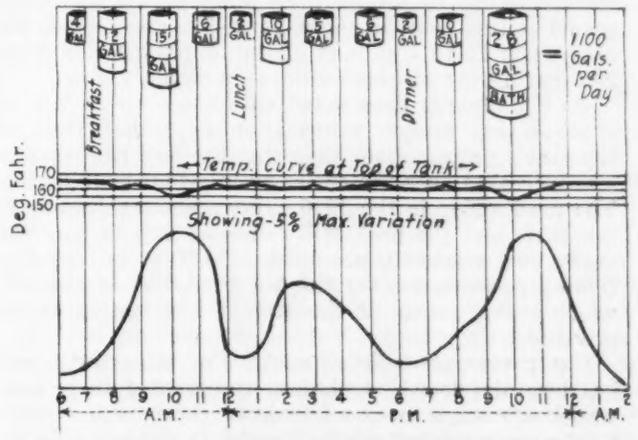


FIG. 3—HOURLY CHARACTERISTICS OF THERMALLY CONTROLLED WATER HEATING LOAD

which have load characteristics tending to produce a cumulative peak at the desired valley hour.

With these thoughts established, it is at once evident that the characteristics of the year's total growth should first be carefully studied and from these characteristics the coming year's commercial effort so laid out that by concentrating upon the proper kind of "made" load the result will be the development of such business as will have load peaks and characteristics which will balance the undesirable characteristics of the natural growth.

Limitation of space permits no attempt at a discussion of the "curing loads" for undesirable natural growth, for they will be different for each central station in terms of the various classes of service available for development and the general characteristics of the majority of the station's consumers. The purpose of this article is, however, to present a brief description of the basic method, together with an example which will show the necessity of some methodic analysis.

The studies herewith presented are typical only of the Western central station, but, again, the method of analysis, which is the central idea, may be applied to any type or series of load curves, and when the basic principles here given are elaborated upon, a comprehensive analysis may be readily developed which will clearly bring out the nature of the load which next year's commercial effort and expense should be concentrated upon in order to most effectively balance the characteristics of the natural growth individual to whatever central station may be under analysis.

Cooking and Water Heating as Examples

Having chosen a typical central station situation, cooking and water heating are taken as examples of "made load," in so far as they have load characteristics directly opposing each other, and further, since amplified domestic service seems to be the target of the greater part of commercial effort put forth by the new-business departments of the various central stations having water power as a main or auxiliary source of energy supply.

Referring to Fig. 1, we have the ordinary graphic presentation of the load curve growth which has been laid down for the years 1915 and 1916 by averaging for each year the thirty-one daily system load curves accruing during the month of December.

For the purpose of this discussion the off-peak period is taken as those hours during which the load curve remains below the mathematical average of the twenty-four hours' load—which leaves the on-peak period to include those hours of the day when the load curve rises above the average.

On a system developing such an appreciable drop at noontime, due to the shutting down of the industrial plants at this hour, it might be well to also include the hour from 12 to 1 as part of the off-peak period when considering the off-peak hours as a whole.

As has already been noted with reference to Fig. 1, it gives very meager information as to the nature of the year's growth other than that the load has more or less increased over the entire twenty-four-hour period. The noon valley in the 1916 curve seems as deep as in the 1915, and the peak still comes at 6 p. m. and the valley load reaches a minimum at 4.30 a. m.—a satisfactory presentation for the lay mind, but an analysis which conveys none of the desired information to the executive.

Fig. 2 presents a detail analysis of the growth, and has been developed by plotting the gross gain in kilowatt-hours on a twenty-four-hour chart with a sufficiently exaggerated vertical scale to definitely locate those periods of the day when the greatest increases in load, both normal and "made" growth, are manifested. As noted in the legend of Fig. 2, the heavy line tells the story of the actual growth, from which it might be noted that the load curve is increasing more rapidly at 6 p. m. than at any other hour of the day.

Referring to Fig. 1, we note that 6 p. m. is the one hour of the day when an increase in load is least desirable, or, expressing it differently, we note that increases at 6 p. m. are more costly to the station than at any other hour of the day. The increase at 12 o'clock noon, however, is developing at a very satisfactory rate, which would be gratifying on all systems where the hour of 12 to 1 is considered off-peak.

The third point of most rapid increase in the normal growth is noted between 7.30 and 8 a. m., and hence new business tending to cause a rapid increase in the load at this hour would warrant less commercial effort on those systems having a large industrial load, due to the fact that between 7.30 and 8 a. m. would come the industrial peak caused by simultaneous motor starting loads in practically every industry on the system.

The curve traced in dashes and superimposed upon Fig. 2 is a typical electric-range load curve taken from cumulative studies made on 1000 ranges.

The heavy dotted curve is a projected curve showing the characteristics of thermally controlled water-heating apparatus, its peaks coming directly following the dish-washing periods, and its greatest peak coming around 10 p. m., due to the coincidence of the evening dish-washing and bathing hot-water demands.

Neither the cooking or water-heating curves are plotted to scale, but they are true with respect to each other and, having such opposite characteristics, serve admirably as examples of this method of analysis, by which the utility operator is shown at a glance the relative value of range, water-heating loads, or any other

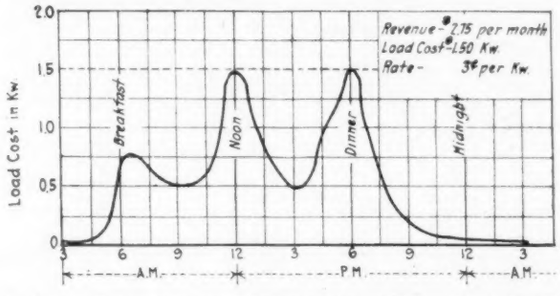


FIG. 4—HOURLY CHARACTERISTICS OF ELECTRIC RANGE LOAD

type of business, after the typical curve of each class of business has been laid down against the growth curve. The relative value of the range and water-heating business to the load shown is too immediately self-evident to warrant discussion, for the peaks of the range load, corresponding at every point with the peaks of the normal growth, indicate that the development of any business having these load characteristics is but adding to the peaks already forming at an alarming rate, whereas the development of any class of service having load characteristics such as are indicated by the thermally controlled water-heater when applied to a system such as shown, would tend to fill up the valleys of the normal growth.

The writer fully appreciates that there are many conditions to be considered other than a purely theoretical analysis of the load. For instance, in a hydro-electric situation, if the system peak was approaching the carrying capacity of the high-tension line, it is apparent that commercial effort might be profitably doubled or even tripled upon the development of loads having the characteristics similar to the thermally controlled water heater. On the other hand, if transmis-

sion capacity were of no particular moment it might be possible that hydroelectric storage capacity would be of prime importance, and in that event the system such as discussed here might well double or triple their commercial effort upon loads having characteristics similar to the range load, in order that limited water storage might not be sacrificed to the lower unit rate which would inherently be earned by the water-heater type of load which would fill up the valleys of the normal growth.

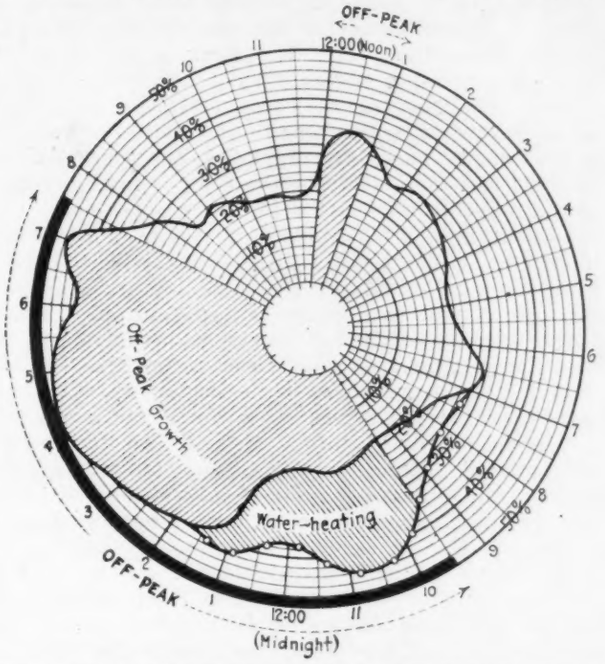


FIG. 5—POLAR CO-ORDINATE DIAGRAM OF PERCENTAGE GROWTHS, SHOWING OFF-PEAK AND ON-PEAK INCREASES—ALSO RESULT TO BE EXPECTED OF SUPERIMPOSING A WATER HEATING LOAD

Whatever the local conditions and limitations may be surrounding the individual situation to which this method of analysis may be applied, it is apparent that when each class of load available for development has been analyzed by superimposing its load characteristics upon Fig. 2, each available source of new business will be shown to have a different value to the central station in terms of the nature of its load characteristics and the location of its peaks with respect to the peaks of Fig. 2. Furthermore, each class of service has a different development cost per kilowatt of load secured, in terms of the amount of pioneering and campaigning it is necessary to undertake and the extent and nature of the competition encountered.

With the relative cost of development known, and, from the application of this analysis, the relative value to the system of each class of service determined, the logical conclusion is, then, the selection of those classes of service which combine the greatest value in load characteristics and the lowest exploitation cost per kilowatt of load secured. With the results of this selection constantly in mind, all commercial effort and expense for the new year should be so directed as to tend toward the development of the most highly desirable classes of service.

Fig. 5 gives a rather novel presentation of the year's growth when analyzed in terms of percentage increase. Since all commercial effort is primarily aimed at the development of the off-peak loads, then when the gross increase plotted in Fig. 2 is reduced to percentage and plotted on a polar-co-ordinate chart and the off-peak period shaded, a presentation is secured which shows the effectiveness of the past year's commercial effort.

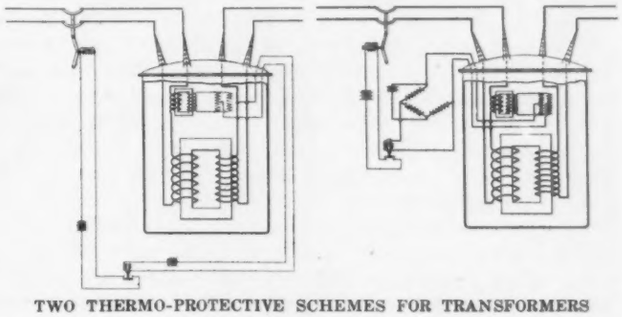
A utility operator producing such a generous increase during the off-peak periods as is shown in Fig. 5 should indeed be gratified.

Referring again to our examples of range and water-heating values, we find that on a system where electric cooking was actively campaigned for we should expect a substantial increase during the noon hour, such as is shown in Fig. 3, between 12 and 1 p. m. And with reference to the thermally controlled water-heating load shown in Fig. 2, if it be conceded that the effect upon the system load of this class of service would result in a peak between 10 and 11 o'clock, we then see that by superimposing a water-heating peak upon the analysis in Fig. 5 it would, in certain stations having characteristics similar to those analyzed here, be possible to maintain a steady increase during the off-peak hours. Such a chart as Fig. 5 might be incorporated in the company's annual report accompanied by a paragraph explaining why the ratio between "off-peak" and "on-peak" growth is the true index of the company's progress and commercial success.

Automatic Thermal Cut-Outs for Transformers

A number of patents have been issued recently for transformer thermo-protective devices designed to be located within the transformer tanks themselves. Inasmuch as transformers are capable of carrying material overloads without injury because of their superior ventilating, radiating and heat-dissipating properties, it is necessary to disconnect them from circuit only when their temperatures reach dangerous or destructive values. Charles Le G. Fortescue of Pittsburgh, and A. W. Copeley of Wilkinsburg, Pa., in patents respectively 1,210,058, and 1,210,049, show methods of controlling circuit interrupters by virtue of change of resistance with the temperature rise in the transformers.

In the Fortescue device a constant potential circuit comprising a battery and an electro-responsive device such as a solenoid switch is connected across equal-potential points of the resistor. When the resistance of the resistor within the transformer changes, because of a change in temperature, the current will vary substantially in accordance with variations in the temperature of the resistor. In the Copeley device, in order to preclude the improper functioning of the electro-responsive switch, a resistor is provided that is heated in accordance with the energy that traverses the transformer. By providing a Wheatstone bridge, one arm of



TWO THERMO-PROTECTIVE SCHEMES FOR TRANSFORMERS

which comprises the resistance of the resistor between equal potential points and a battery across two of the terminals of the Wheatstone bridge and the electro-responsive cut-out switch across the remaining terminals, when the resistor is heated to such a degree that it is advisable to disconnect the transformer, the resistance across the equal-potential points is sufficient to cause the Wheatstone bridge to become unbalanced, thereby de-energizing the electro-responsive switch.

Electric Motor Drive in Paper Mills

Load Conditions and Sizes and Types of Motors for Operating "Jordans," Beaters, Fourdrinier Machines, Calenders, Saws, Barkers, Pumps, Etc., Used in Paper Manufacturing Processes

ELECTRIC-MOTOR drive for paper mills has many advantages, and often, to quote the opinion of the manager of a large eastern mill, the possible increased production alone will warrant the expense of the change from mechanical to electric drive. Both individual and group drive are used, but individual drive is especially desirable where variable speeds are required, as in the case of the paper machine.

Woods used for paper manufacture include poplar, fir, pine and hemlock. Mills manufacturing wood-pulp paper may be divided into two general classes, those which make the pulp required and those which purchase the pulp. The manufacture of wood pulp, especially mechanical pulp, involves the use of large amounts of power, and where water power is available it is customary to use it for the grinders and chippers, although electric drive is well adapted to the requirements of these machines, and is rapidly displacing water power.

Before taking up the details of equipment, a brief general outline of the manufacturing processes and a description of the principal machines will be given. Cotton and linen rags can be converted into paper of different grades, depending upon the color and quality of the material. The rags are carefully sorted and all foreign material removed, and then again sorted according to quality and cut up into pieces, and later cut to a finer degree by mechanical cutters and the dust removed by machines. The rags are then boiled with suitable chemicals and are ready for the beginning of the machine processes.

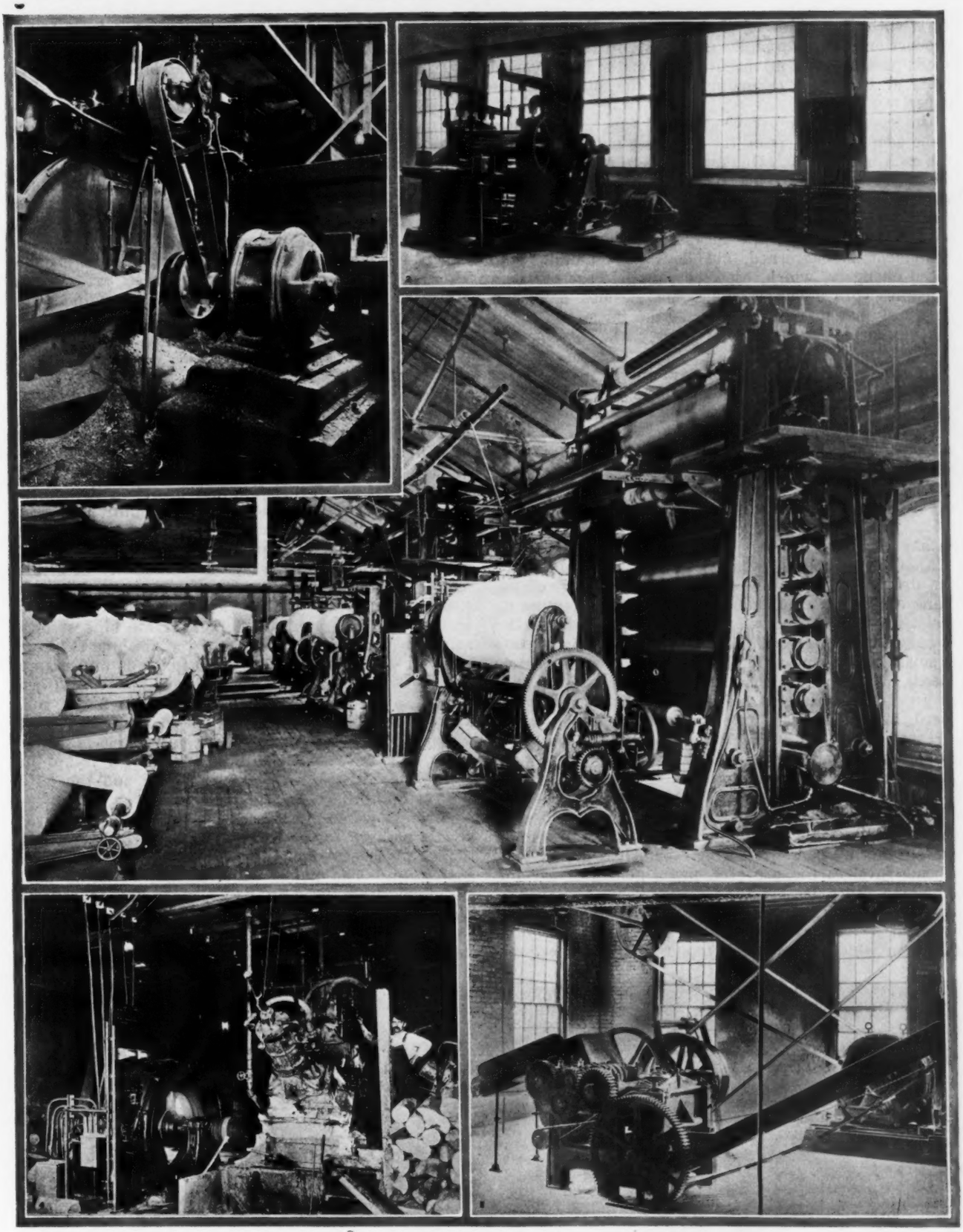
In making wood-pulp paper, fresh green wood is used for mechanical pulp, as it is more easily ground and produces better fiber. Blocks of wood about 18 in. in length are placed in the grinders and held against a grindstone revolving at from 200 to 260 r.p.m. by hydraulic pressure ranging from 30 to 75 lb. By this process the wood is reduced to a pulpy mass, and, during the grinding, the stone is sprayed with a stream of water to prevent burning of the wood. The pulp is then screened and is transferred to the beaters, where it is mixed with other stock that may be desirable, and is then rolled into sheets by wet machines, ready for storage or shipment, or it is transferred to the paper machine direct. Pulp grinders with a 27 by 54-in. stone require from 300 to 600 hp., depending upon the pressure and the size of the pockets. Chemical pulp is made somewhat differently, as the wood is chipped in chippers and treated with chemicals in digesters, where different combinations are employed to secure different grades of pulp.

From this stage the preparation of the raw material and the manufacture of the paper from rags and wood pulp, is in general, similar. The beaters which are used for refining the pulp consist of an oval-shaped tub with a partition half way across the center corresponding with the rectangular section. A heavy roll with knives in the periphery, parallel to the shaft, is rotated between one side of the tub and the partition. This roll is adjusted with reference to a bed plate, which consists of a number of steel plates standing on edge. The adjustment of the roll has to do with the ultimate condition of the fiber, as all of the stock passes between the roll and the bed plate. Clean water is constantly added to the stock while the dirty water is removed. The bleaching process sometimes takes place in the beater by means of adding the required bleaching solutions. From the beater the stock is generally run through a "Jordan engine," which consists of a cone-shaped plug made of hardwood and steel bars, fitted into a hollow concentric cone lined with a filling similar to that of the plug. By regulating the space between the plug and the outer cone the stock is finally reduced to the proper condition for the paper machine.

Sometimes it is desirable to drive the Jordans and beaters by different motors, as in some mills the entire stock is not subjected to the last refining process. Both the Jordan and the beater are operated at constant speed, but the power for operation depends upon the condition of the stock and the adjustment of the machine. When, however, all of the beaters supplying one paper machine are driven by a single motor the load will be practically uniform. Motors with high torque and constant speed characteristics should be used for beaters, and shunt-wound, direct-current motors, squirrel-cage and slip-ring induction motors are all operated on this service.

The power required to drive beaters is a variable quantity, but from tests it has been determined that a good rule to follow is to allow 1 hp. for each inch of width of the beater roll. For work on light stock, such as ground wood, sulphite fiber, old papers, etc., with a moderate peripheral speed not exceeding 1600 or 1700 ft., three-fourths of a horsepower for each inch of roll face will generally be found ample. The starting torque for beaters varies considerably, depending upon the methods of operation. If a beater is shut down full of stock, and started again shortly afterward, with the roll down in its running position, the starting torque will be about the same as the normal running torque. If the roll is lifted before starting, the necessary torque will be reduced and the beater will start comparatively easily. If, however, the stock is allowed to stand for some time with the rolls stationary, as on Sundays, the fiber settles to the bottom, clogging the roll, and requiring more than normal torque to start it, even if the roll has been lifted above its running position. For this reason, slip-ring motors are often recommended for beaters, as they give a better starting torque. Beaters lend themselves to either group or individual drive.

For newspapers and other kinds of paper, as well as rag paper, the Fourdrinier paper machine is in general use. The machine can be conveniently divided into two parts, the constant-speed part consisting of the pump, felt beater, shaker and screen, and the variable-speed part, which includes the wire press rolls, dryers, and calenders. The constant speed requirements are from 25 to 30 per cent of the total machine power requirements. A considerable range of speed variation with fine increments is essential for the variable-speed portion of the machine, and the common method is to employ a shunt-wound, variable-speed, direct-current motor or a constant-speed induction motor in connection with some form of mechanical speed-changing device. Satisfactory results are obtained by the combination of an adjustable-speed interpole motor, the motor having a field rheostat with from 60 to 90 points. The power requirements of a Fourdrinier machine



Electric Motor Drive in Paper Manufacture

The center illustration shows a group of four motor-driven super-calenders operated by the P. H. Glatfelter Company at Spring Grove, Pa. Other applications of motor drive in the paper mill industry are pictured in the upper and lower panels on this page. Electric drive is rapidly replacing other sources of power for operating the grinders and chippers which are used in making wood pulp. The illustrations show the trying conditions under which such motors operate; sawdust does not hinder the induction motor. The pulp is refined in beaters and later reduced in "Jordan engines." Both of these machines are operated at constant speed, the power requirements varying with the adjustment. Motors for beaters must have high-torque with constant-speed characteristics.

vary with the width of the paper and the speed of production. For example, in a test of the variable-speed part of a 152-in. machine, the motor input varied from 87 to 92 hp., depending upon the quality of the paper.

On account of the great variety of paper, the method to be adopted for driving the machines must be studied for each installation. One method is to use a constant-speed motor for driving both the constant and the variable-speed ends of the machine with a mechanical speed changer between the motor and the variable-speed shaft. This is the cheapest as far as electrical equipment is concerned, but does not eliminate the speed changers, which, especially in the case of large machines, prove very troublesome, besides having a first cost that may entirely offset the initial saving in the electrical equipment. In most cases this method is not recommended.

In a second method, a constant-speed motor drives both the constant and the variable-speed end of the machine, the speed variation being obtained by changing the pulleys driving the variable-speed shafts. This gives a low total cost, but does not give any fine speed adjustments, and it requires considerable time to change pulleys, and should be used only in cases where it is expected to run on one grade of paper for a long period. This is also more or less of a makeshift as far as electric drive is concerned.

Another method is to employ a constant-speed motor for driving the constant-speed end of the paper machine and a slip-ring induction motor with regulating resistance to drive the variable-speed end. This method is only applicable when the amount of speed variation is small, on account of the poor speed regulation at low speeds. Such installations have proved successful with as great as 40 per cent reduction below the maximum speed, but it is a safe rule that the largest variation of speed with such an installation should not be below 20 per cent of maximum speed.

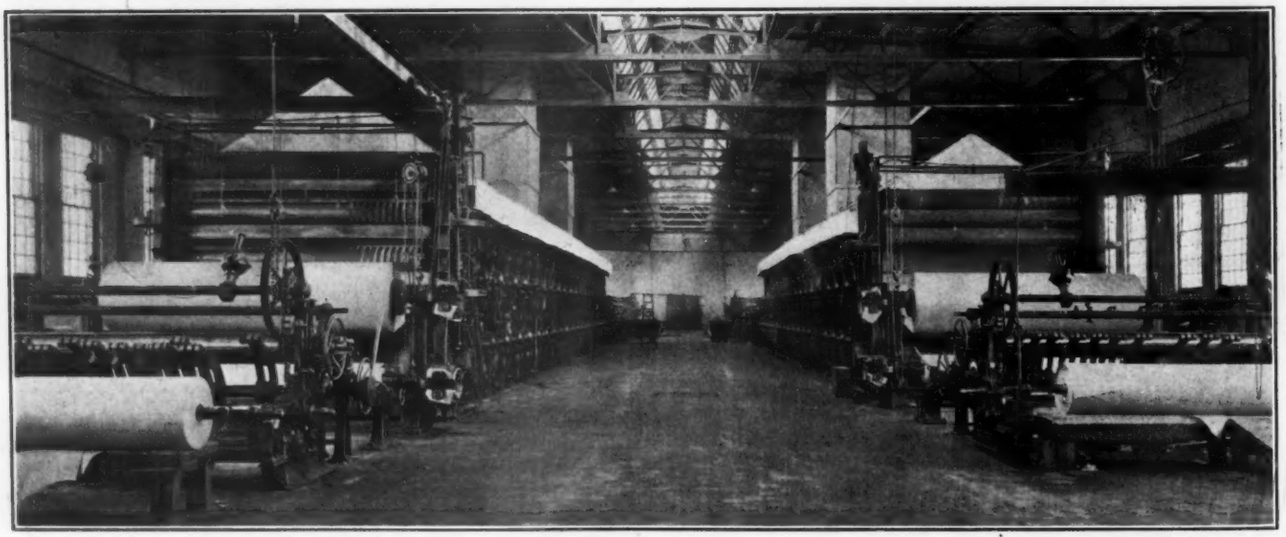
Still another method is to use a constant-speed motor for the constant-speed end of the paper machine and an adjustable-speed, direct-current motor with field control on the variable-speed end. Since most paper mills use alternating current for their principal drives, this scheme involves the use of a motor-generator set for supplying the necessary direct current for the adjustable-speed motors. The range of speed which can be obtained by this method is limited by the economical range for which it is possible to obtain adjustable-speed motors. This limiting range is about 4:1, and it is preferable to confine it to 3:1.

In some instances, a method that is used consists of installing a constant-speed motor for the constant-speed end of the machine, with the speed variation of the motor driving the variable-speed end of the machine obtained by voltage control. By this method it is possible to obtain speed ranges of 5:1 or 6:1, and greater, by purely electrical methods. The generator for supplying the direct current for the variable-speed motor is usually driven by an induction motor. It is also possible to omit the motor driving the constant-speed end of the paper machine and drive this from a pulley on the motor-generator set. Another arrangement which has been considered is to use an engine belted to the constant-speed shaft and belted or direct-connected to a generator and exciter, which would furnish power for the motor driving the variable-speed end of the machine.

There is a modification of the voltage-control system which has certain features of superiority, consisting of a combination of a certain amount of field control of the motor driving the variable-speed shaft with voltage control. With this method of voltage and field control, 10:1 speed variation may be obtained.

For driving the calenders, a slow and uniform threading speed is essential, and there must be a gradual acceleration from low to high speed, with ability to slow down and accelerate again. Simplicity of control and operation is also important. Electric drive, for these reasons, is especially adapted to this work, as each weight of paper can be run at the highest operating speed and the operation of the machine is always under instant control. Two-motor drive is well adapted to calenders, one a small squirrel-cage motor with gear reduction for threading the paper through the rolls, and gradually accelerating the speed by means of the larger motor. In a large Eastern mill the 66-in., 72-in., and the 86-in. calenders are equipped with 75-hp. and 15-hp. motors, the former for driving and the latter for threading in.

Power required for presses and trimmers varies from almost nothing to the maximum, and properly proportioned flywheels should be included in the machine equipment. The power requirements of some additional machines used in paper mills are as follows: Water pumps, 10 to 20 hp.; saws and barkers, 10 to 15 hp.; stuff pumps, 5 to 10 hp.; elevators, 3 to 10 hp.; cutters, 5 to 10 hp.; exhaust fans, 5 to 15 hp.



EACH OF THESE ELECTRICALLY-DRIVEN PAPER MACHINES HAS A CAPACITY OF 150 MILES OF WRAPPING PAPER 13 FT. WIDE, PER DAY. THESE MACHINES ARE A PART OF THE MILL EQUIPMENT OF THE UNION BAG & PAPER COMPANY AT HUDSON FALLS, N. Y.

Performance of Two Successful Windmill Generating Plants

Considerations on Which Selection of Equipment Was Based, Features of Arrangements Employed and Results of Tests Showing Ability of Plants to Utilize Wide Range of Wind Velocities

BY FRANK S. CULVER

GENERATION of electricity by wind power is a problem that has been studied by numerous inventors for many years, yet very few of them have compiled data which can be used in the design of small rural lighting plants. Furthermore, most of the arrangements which have been tried out have been abandoned owing to their complexity, inefficiency or cost. Believing that there would be a field for wind-power generators, however, if a simple and durable construction could be developed, the writer installed two experimental plants in Wisconsin and conducted extensive tests to determine the best method of utilizing the wind.

Upon investigation it was found that all previous investigators had one idea in common, namely, that electric power could be generated economically by wind power only through the medium of a storage battery. On all other phases of the subject there were almost as many opinions as experimentors. The first thought of nearly all inventors seems to have been that the variable speed of the windmill is not suitable for charging a storage battery, and must in some manner be brought to a more nearly uniform speed or damage would result to the battery. In attempting to secure speed regulation some used centrifugal governors and brakes, others employed belt drive and permitted slippage, and still others used hydraulic motors operated by water which had been elevated by the wind mill. Each of these arrangements is undesirable, however, the first being wasteful of power, the second self-destructive and the third too complicated and expensive.

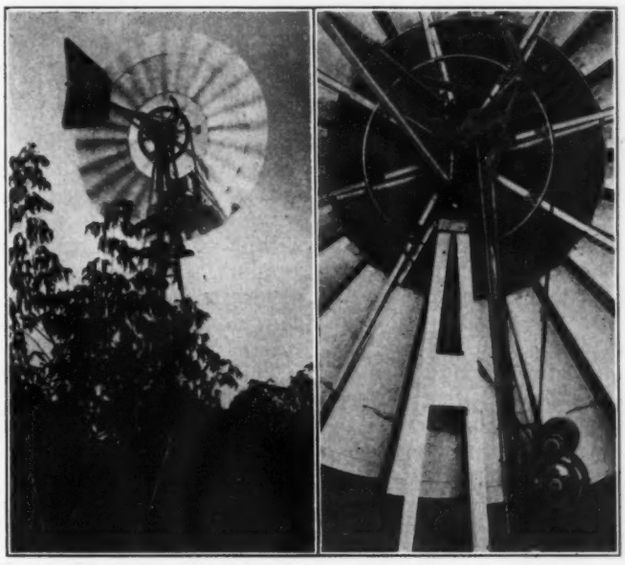


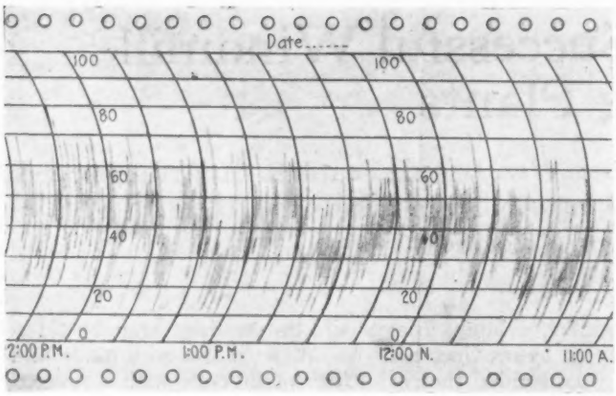
FIG. 1—WINDMILL-OPERATED GENERATING SET IN NORTHERN WISCONSIN WITH GENERATOR ATTACHED TO TURNTABLE

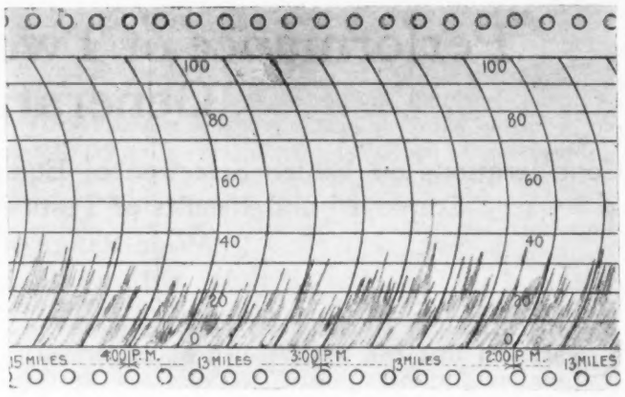
Very little data could be obtained from a careful search of the libraries and little reliable information could be obtained from manufacturers regarding the performance of their mills. About the only data obtained that were usable were secured from the United States Weather Bureau. These showed the annual average wind velocity for Wisconsin to be about 9.9 miles per hour. Since the wind is more active during the day than at night, it was assumed that the average daytime velocity would be about 14 miles per hour. From the Weather Bureau reports it was also found that the lowest wind velocities occur in June, July, August and September—the months with the longest days and therefore the periods requiring the least amount of artificial light.

Having decided to erect an experimental plant on a farm in northern Wisconsin, a rough estimate of the number of lamps that would be required and the number of hours that each would be in use was made and it was decided that a battery of 26 cells with a normal discharge rate of 3 amp. for eight hours would be ample to provide lighting for several nights on one full charge of the battery. For charging the battery, a generator rated at 3 amp. and 65 volts was selected. As the maximum speed of the windmill in heavy winds was somewhat uncertain, the question of generator speed was left for further consideration. From the information obtained on wind velocity it was decided to erect an ordinary pumping-form 12-ft. wind mill on a 50-ft. steel tower. By experimenting, it was found that the speed of the windmill did not exceed 75 r.p.m. in a wind of 30 miles per hour when running without load, due to the regulating features of the windmill. With this speed fixed, it was an easy matter to provide the proper sized pulley for the generator. To assure charging with winds of low velocity, a generator was selected having a normal speed of 900 r.p.m., but having a pulley ratio which made it operate at 1800 r.p.m. with the maximum windmill speed of 75 r.p.m. Heavy charging current at the higher speed was prevented by a differential winding. A study of the accompanying chart will show how well this regulation was cared for.

A waterproof generator was employed, being attached to the turntable of the windmill, below the axis and a little to one side. As shown by the accompanying illustration, it was connected thereto by a sprocket wheel and standard automobile chain. From the generator, wires were conducted down through the hollow center posts of the mill, and terminated in a set of collector rings. Connections were made with the storage battery by means of collecting brushes attached to the stationary frame work of the windmill. This arrangement permitted the windmill to turn in any direction with change of wind without requiring any complicated transmission mechanism.

As this plant was constructed principally for the purpose of gathering information for the design of larger plants, it was connected with a switchboard on which was mounted voltmeters, ammeters, graphic recording ammeters, watt-hour meters and an anemometer for recording wind velocities. The anemometer cups were placed sufficiently above the windmill to be out of the influence of the wheel. By means of an automatic cut-in the generator is connected with the battery





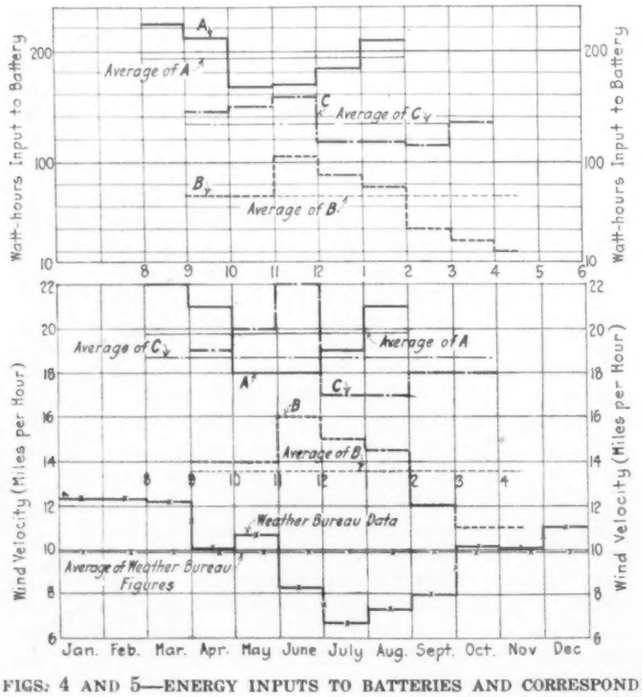
FIGS. 2 AND 3—CHARGING RATE OF CHAIN-DRIVEN GENERATOR AND EFFECT OF AUTOMATIC CUT-OUT DURING LOW WIND VELOCITIES
The curve in Fig. 2 refers to conditions represented by curves A of Fig. 4. Each horizontal line represents 1 amp. As shown by Fig. 3 the generator was automatically cut out about forty times in one hour due to low wind velocity.

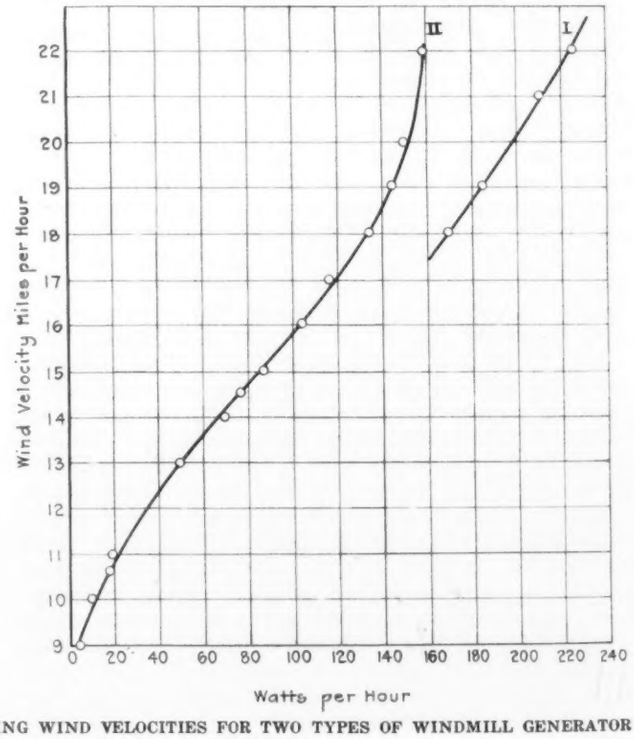
whenever the generator voltage is in excess of the battery voltage and is disconnected just before the current reaches zero value or point of reversal.

Nightly records were made with this plant and the results obtained shown in Fig. 4. It may be noted that with an average wind velocity of 19.8 miles during a six-hour test, the battery was charged only slightly above its normal rate of 3 amp. This is also shown by the graphic recording meter chart, Fig. 2, each horizontal line of which represents 1 amp. The curve in Fig. 6 shows the amount of energy used on the evening of May 25 and is an average of several others taken at various times. This chart shows that lamps were lighted at 7.15 p. m., the load becoming a maximum at 7.45 p. m. This load, which was the normal full load for the battery, continued until about 8.40, when a decrease commenced, the last lamp being extinguished at 10.10 p. m. During this period, 260 watt-hours were drawn from the battery according to the watt-hour meter. Since Figs. 4 and 5 show that the battery was charged at a rate of 193 watt-hours per hour, this shows that the rating of the equipment was properly selected. In this connection, it should be pointed out that one day's charging furnished enough energy for four nights' illumination. During the shortest days of the year, lamps would be required about two hours earlier, but observations of wind movements show that wind velocities are greater at the same time, thus insuring sufficient power for the generation of this extra energy.

Although mounting the generator at the top of the windmill as described affords a very efficient drive, the generator is inaccessible. It was therefore decided to erect another experimental plant in which the generator would be placed in a building at the base of the windmill tower, either on the floor or on a shelf. This arrangement made it necessary to adopt a power type of windmill, but it also permitted the use of an open-type generator and the elimination of sprockets and chains, as well as the collector rings. For these reasons, the cost of the two systems was about the same.

The second plant was erected in southern Wisconsin and consisted of a 12-ft. wheel mounted on a 50-ft. tower driving a 6-amp. 35-volt, 900 r.p.m. generator. The battery used in conjunction with this equipment was rated at 6 amp. and consisted of fourteen cells. A standard windmill with a vertical shaft terminating in a footjack in the lower part of the tower was employed





FIGS. 4 AND 5—ENERGY INPUTS TO BATTERIES AND CORRESPONDING WIND VELOCITIES FOR TWO TYPES OF WINDMILL GENERATOR PLANTS INSTALLED FOR EXPERIMENTAL PURPOSES IN WISCONSIN
Curves marked A and I refer to an outdoor chain-driven windmill generator and curves B, C and II refer to an indoor bevel-gear belt-driven plant. Curves marked with corresponding letters refer to similar conditions.

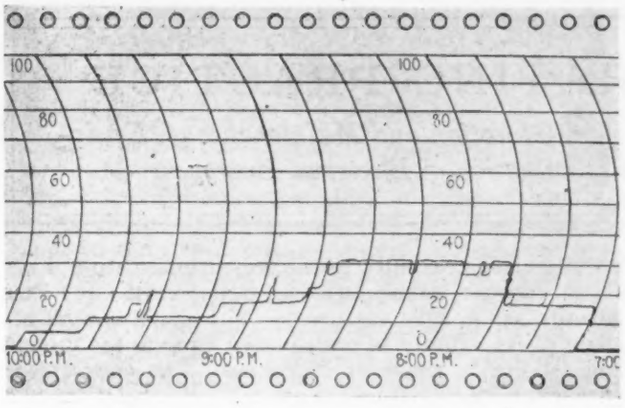


FIG. 6—VARIATION IN LOAD ON GENERATOR ON A TYPICAL SUMMER DAY (MAY 25)

and bevel gears used to transmit power to a horizontal shaft extending into the building. The generator was connected to this shaft by an ordinary pulley and belt.

Results obtained from this plant at different wind velocities are also shown in Figs. 4 and 5. As shown by comparing the figures on the two plants, it can be seen that there is very little difference in efficiency, the cost is the same, but the last plant erected has the advantage of greater simplicity and suggests the possibility of using this system in connection with any power windmill that may be already in use. Since some of these plants have been in operation for six years, furnishing illumination every night, there seems to be no question as to their durability.

The curve in Fig. 3 is interesting, as it shows the action of the outfit when operating at a low wind velocity. In one hour the generator was connected and disconnected about forty times. This performance speaks well for the design of the cut-in and it is very important as this condition may exist for days at a time. Furthermore, it demonstrates that it is possible to fully charge a battery even on days when the wind is gusty and low velocity.

Results of tests on the chain-driven and geared type plants are shown in Fig. 5. From an examination of these curves it will be noted that with a wind velocity of 22 miles per hour, the charging rate of the geared plant had nearly reached a maximum, while with the chain-driven plant the charging current was increasing almost directly with the wind velocity. This action is due to the difference in adjustment of the differential windings of the generators. In the first case, nearly the entire winding was effective, while in the other it was nearly all cut out of circuit. Thus, by adjusting the amount of the differential winding in circuit, the peak charging current can be easily controlled. Another interesting fact is the low wind velocity at which the generator will charge the storage battery, current being furnished with a wind velocity of only 10 miles per hour.

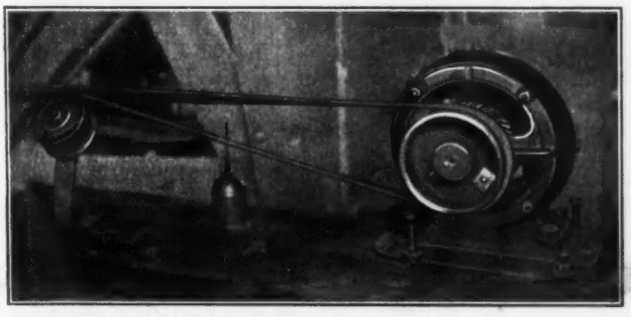
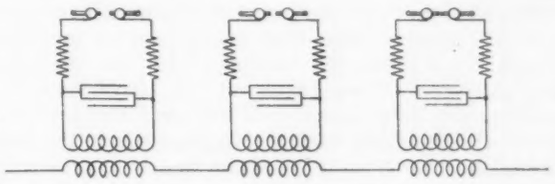


FIG. 7—INDOOR GENERATOR CONNECTED WITH WINDMILL SHAFT BY BELT AND BEVEL GEARS

Scheme for Lightning Arrester

The older forms of lightning arresters have, as the underlying principle, the fact that an inductance or capacitance in a line acts as a reflector for the electrical disturbances impressed thereon. This theory of reflections appears to be due in the main to Oliver Heaviside. With the advent of resonance circuits in wireless telegraphy the decremental energy losses in a spark gap circuit has suggested patent 1,212,128, issued to Alexander Cherynshoff of Swissvale, Pa. This is an application to power circuits which may be subject to high frequency destructive surges set up by whatever cause.

Instead of reflections taking place which heretofore required that the surge energy be either dissipated in the line or be allowed to slowly filter through the protective devices to the machinery one wished to protect, such oscillation circuits act as unreflecting absorbers of the surge energy to the more perfect protection of the line. By connecting a condenser in shunt with the secondary windings of an air core transformer, the transmission



MEANS OF PROTECTION AGAINST STRAINS DUE TO HIGH FREQUENCY CURRENTS

line conductor is instantaneously relieved of high-frequency disturbance, inasmuch as the condenser absorbs the charge by reason of the close inductive interlinkage between the primary winding and the secondary winding when subjected to the high-frequency impulses. When the quantity of electricity absorbed by the condenser raises the potential of the condenser and subjects the spark gap to a sufficiently high voltage to effect discharge, the auxiliary discharge circuit will oscillate at a frequency in excess of the original disturbance because of the low inductance of said auxiliary circuit.

Thus it will be seen that a plurality of protective devices may be inserted in series with each line conductor, each device being so constituted as to dissipate most effectively the energy of disturbances having frequencies and quantities of energy within limited ranges. In this manner, protection may be afforded a system against disturbances of a wide range of frequency and quantities of energy. Moreover, no ground connections or connections between adjacent transmission conductors are required, which condition greatly affects the insulating properties of the line. After the devices have been once installed, it is unnecessary to have frequent inspections, such as are required when electrolytic condensers are used.

Indirect Publicity Considered Effective at Indianapolis

The newspapers and the public of Indianapolis, Ind., have of late been devoting much time to discussing the lack of community interest or civic pride in the Hoosier capital. In order to do its share to restore public interest in city affairs and progress, the Merchants Heat & Light Company of Indianapolis has been publishing a series of indirect advertisements which are taking the form of parodies on some of the Riley poems, telling of the "No-Community Interest that'll git yer, ef you don't watch out." The company has for a long time been a believer in indirect publicity, and has particular faith in the value of this series of advertising.

STATION AND OPERATING PRACTICE

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

A MONTANA ALUMINUM LINE DISMANTLED AT A PROFIT

Load of Two 50,000-Volt Aluminum Transmission Lines 60 Miles Long Now Carried by Steel Tower Copper Line Reinsulated for 100,000 Volts—Salvage of Aluminum About $60,000

Recently advantage has been taken of the high price of aluminum by the Montana Power Company in the reconstruction of transmission lines from its power stations on the Madison River to Butte. Originally three 50,000-volt lines were constructed between these points, two of them using aluminum conductors on wood poles and one No. 0 copper on steel towers. The steel tower copper line has been reinsulated for 100,000 volts and the aluminum lines abandoned. General Manager F. M. Kerr of the Montana Power Company gives the cost of reinsulating the 60 miles of tower line as approximately $17,000, with a salvage on aluminum from the other two lines at 52 cents a pound f.o.b. the Butte railway station, of approximately $60,000.

The aluminum lines were built in 1901 and consisted of a double pole construction 60 miles long. Wood poles 40 ft. tall spaced 180 ft. carried conductors in triangular spacing, on one crossarm with two insulators and an insulator on top of the pole. Pin-type glass insulators of the "Prove" design were used. The conductors were of seven-strand aluminum, each strand being No. 10 B & S gage, making the line equivalent in section to about No. 1 copper. The conductors were originally tied on the side of the glass insulators with No. 4 solid aluminum wire. These ties wore out in the first two or three years and were replaced by ties of No. 8 weatherproof copper. After several years the conductors began to show wear at the contacts with the insulators and after about twelve years of service it was found necessary to reinforce the conductors at every insulator. This was done by taking a short piece of aluminum, about 18 in. long and clamping it to the conductor with two Crosby clamps and again tying the conductor to the insulator.

While these two aluminum lines have been in continuous service fifteen years, Mr. Kerr states that it has been known for the past several years that on account of their condition, the time was rapidly approaching when they must be abandoned. The present high price of aluminum appeared to offer an opportune time to get the largest amount of salvage from the aluminum and hastened the work. The growth of business has made it advisable to change to 110,000 volts. This raised the rating of the tower line to approximately 10,000 kw.

The experience and observations of the Montana Power Company have led its engineers to favor copper over aluminum for long-distance transmission lines for the following reasons: (1) Aluminum is softer and weaker and particularly susceptible to abrasions at points of support. (2) Aluminum has a lower melting point and is easily burned in two and destroyed by arcs. (3) Where the wires are supported on suspension insulators, side swinging to the wind must be considered. Aluminum is at a disadvantage in this respect and on account of its light weight and large area will swing up into close proximity to the crossarms, cutting down the necessary clearance to a dangerous extent. (4) Fire hazards and danger are greater with aluminum on account of its liability to burn in two, drop to the ground and set fire to whatever it touches. The ends of the wire will burn free from the ground and hang down as a menace to human life.

How a Power Company at Niagara Falls Utilizes Trolley Boat to Prevent Ice Jams

BY RAYMOND FRANCES YATES

The trolley boat shown in the accompanying illustration, which has been used for a number of years by one of the large power companies at Niagara, has been found a practical means of preventing ice jams in the intake canal of its power station. For this purpose it is more effective than a steam tug since it can be handled with greater ease and is much faster in its action.

TROLLEY ARRANGEMENT FOR OPERATING ELECTRIC ICE BOAT IN A FOREBAY

The power equipment of the craft consists of a 75-hp., single-phase, 220-volt, 25-cycle railway motor with the ordinary drum controller and grid resistances. The maximum load speed of the motor is 1000 r.p.m., which gives the propeller 240 r.p.m. by means of a single reducing gear with a ratio of 16 to 66. As the motor starts at heavy torque, the boat accelerates very rapidly to full speed which is very desirable in this work. The device at the top of the pole in the illustration is a commutator arrangement that permits the boat to travel in any direction. The purpose of the boat as now used is not to break ice, but to keep it moving in the direction of a small spillway at the end of the canal, where it drops into a perpendicular shaft that discharges into a big tunnel.

The trolley boat shown in the illustration was constructed by the Niagara Falls Power Company and first used in 1912. One of similar construction, however, was built in October, 1905, by the Canadian Niagara Power Company, and has been in service ever since.

How Quarry Pits Were Used to Store Coal Under Water

BY R. I. ELKIN

An ingenious and inexpensive method of storing large quantities of coal under water was utilized last summer by some of the large coal users in Chicago at the time when all large consumers of coal were busy preparing for the threatened railroad strike. Outside the city of Chicago and in close vicinity thereto are a large number of stone quarries about 25 ft. in depth, some of which have been worked out and are nearly full of water. A number of these worked-out limestone quarries on the Chicago & Alton Railroad, to which tracks ran, were filled with coal. The coal in regular hopper cars was run in on the tracks alongside the quarries and flushed into them by water. Most of the coal so stored consisted of screenings. As it filled up the quarries the water was displaced, the coal being dumped in until between 2 ft. to 6 ft. of water remained above the surface, the idea being to protect the coal from spontaneous combustion. Much of this coal still remains in storage although some has been taken out by suitable suction pumps.

Stage Pressure Observations During Turbine Tests

The primary function of a turbine test is to ascertain how many pounds of steam are required to generate a kilowatt-hour. In a great number of the tests important observations which have a bearing on the accuracy of the test results are overlooked, and as few observations as possible aside from weighing the water and recording the electrical load are made. If the test results show that the steam consumption follows a straight line law all is well and good. However, there are tests in which the line of steam consumption shows a deviation from the Willans law, and many times such data as stage pressures will show the probable cause for the difference. If the stage pressures are taken as the tests are made, as is now done in large plants, the results may be compared so as to demonstrate the condition of the nozzles or of the turbine blading. Changes in the pressures will indicate excessive leakage and deterioration.

In Fig. 1 is shown an arrangement for obtaining the

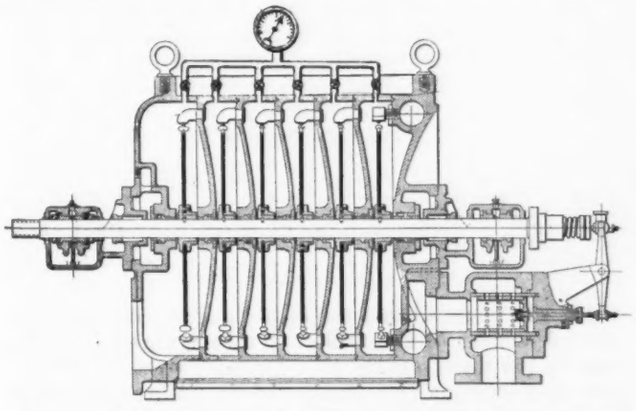


FIG. 1—ARRANGEMENTS FOR OBTAINING STAGE PRESSURES ON MULTISTAGE TURBINE

stage pressures on a small multistage impulse turbine. A 0.25-in. pipe was tapped into each stage and in this short length a valve or cock was placed. The other ends of these pipes terminated in a header to which a steam gage was attached. This provided a permanent method of taking the pressures. If the turbine is used to drive an exciter, the load may be varied by the use of a barrel rheostat, and the steam consumption and pressures taken for different load conditions.

In Fig. 2 is shown the pressures in the various stages plotted against the per cent of rating of an exciter. During this test the steam pressure in the line supply-

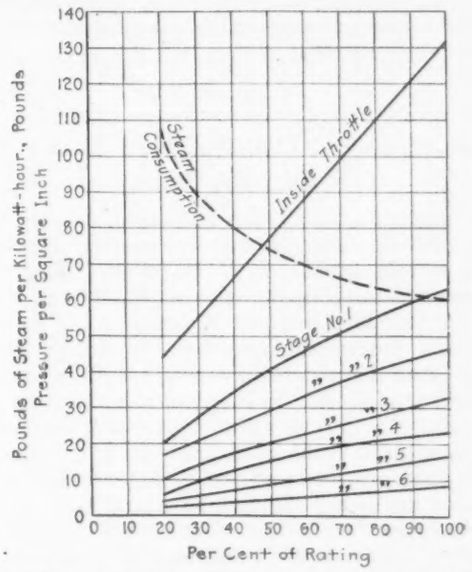

Pounds of Steam per Kilowatt-hour, Pounds Pressure per Square Inch
Per Cent of Rating
Steam Consumption
Inside Throttle
Stage No. 1
" 2
" 3
" 4
" 5
" 6
0 10 20 30 40 50 60 70 80 90 100
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

FIG. 2—STAGE PRESSURES AT DIFFERENT LOADS

ing the turbine varied but slightly, so that the line showing the pressure inside of the throttle illustrates the governor action covering variations in the load. The dotted line is the steam consumption in pounds per kilowatt-hour.

The stage pressure lines are practically straight, and show that there was no undue restriction of steam flow and no leakage in any one of the stages.

An Explanation of an Apparent Difference in Acceleration of Two Wound Rotor Induction Motors

BY E. C. PARHAM

The current in the rotor circuit or secondary of an induction motor depends on the impedance of the rotor and on the emf. acting on that impedance. The amount of the emf. that is active in the rotor circuit depends on the rotor slip which is the difference of the speeds of the rotor and of the rotating magnetic field due to the stator. Since the difference of these speeds represents the rate of the relative cutting of the lines of force of the magnetic field and the conductors of the rotor, it is a measure of the voltage generated in those conductors. The speed of induction motors that have wound rotors is controlled by varying the resistance included in the circuit of the rotor. The speed of an induction motor that operates light, is very nearly the same as that of the rotating field; that is, the speed is nearly synchronous. Under this condition a given change in the resistance of the rotor circuit will have but little effect on the rotor speed, compared to what the same resistance change will have when the rotor is driving a load.

An operator at one time complained to the writer that of two similar induction motors that were applied to the same kind of duty, the speed of one responded more decidedly to the advancing of the controller, than did the speed of the other. He was dissatisfied with the speed control of the less responsive machine.

Trial proved that on one outfit each controller notch made a difference of about 2 r.p.m. of the work while

on the other outfit the speed difference per controller notch was about 4 r.p.m. of the work. Investigation disclosed that the motor with the greater speed variation per notch was connected to a much heavier load than was the other motor and that while it started at a comparatively low speed which increased with the advancing of the controller, the more lightly loaded motor attained a comparatively high speed on the first notch so that there was less margin left for variations.

Insulation of Transmission Lines Near Cement Mills

In a number of instances successful service has been maintained on lines serving or passing cement mills by the simple expedient of extra insulation. It has been recommended in the case of 44,000-volt lines that twice the standard number of disks should be used per string and periodically the line should be killed and the insulator disks carefully wiped with a cloth saturated with transil oil. For 60,000-volt lines, in addition to doubling the normal number of disks, duplicate lines have sometimes been constructed in the vicinity of a mill, so that service need not be interrupted when the insulators are being cleaned, as power can be supplied over one branch while the other branch is dead. These methods of using double insulation to safeguard service have proved equally successful in regions where salt deposit is heavy.

How a Peculiar Case of Poor Commutation Was Traced to Frame Vibrations

There are so many well-known possible causes of unsatisfactory commutation, that when a commutation trouble shows up with a machine of admittedly good design, a trouble seeker is likely to direct his attention to eliminating the most common causes before looking for the more uncommon ones. In one particular instance the generator of a motor-generator set that consisted of a continuous current generator driven by an induction motor mounted on the same and rather long base, commutated badly. The sparking was not sufficiently bad to prevent the operating of the set, but as long as it existed, the commutator could never take a polish.

The operator had checked the speed, voltage, load, polarities, air gap, field drops, brush sets, brush tensions, brush alignments, brush shift and also the switchboard instruments and everything appeared to be perfectly regular. The commutator mica appeared to be flush with the bars, but as it is sometimes difficult to tell with certainty whether or not the mica is a little high, it was decided to slightly undercut it as an experiment. At this time a turbine construction man happened along (turbine men usually are very keen for any condition that is likely to produce vibrations) who noticed that oil was breathing out between the bearing cap and the pedestal of the middle bearing. This struck him at once as a case of faulty alignment, with the possibilities and causes of which he was thoroughly familiar.

Two iron wedges were made and driven under the center of the base on opposite sides of the machine. A relief was immediately noticeable and the vibration that before had been evident only to the most skillful observer was missed at once. The sound emitted by the machine and especially by the brushes, became entirely different and all sparking ceased. Investigation disclosed that the base of the machine as originally set was virtually resting on its four corners as far as the distributing of the weight on the foundation was concerned, and had sagged the long span of the base.

Unit Costs for Setting Transmission Line Wood Poles

There seems to be some question in the minds of readers as to the basis for compiling the unit costs of setting wood poles for transmission lines as given in the round-table discussion of the Ohio Electric Light Association published in the Dec. 23 issue of the ELECTRICAL WORLD on page 1252. E. B. Hook, superintendent of construction Georgia Railway & Power Company, makes the following comment:

"Unit construction costs for setting poles were mentioned by members of the transmission and distribution committee of the Ohio Electric Light Association, and one operator stated that it costs $6 to set a pole, and $1.50 additional cost per pole to obtain the data by which he discovered the unit cost to be $6, thus making the cost for setting each pole $7.50. In the same article a representative stated that he recently compiled data on a 600-pole line and found the labor cost to be $12.68 per pole. It would be interesting to know if the above figures represent merely the actual setting of poles or if they include the expense of handling and hauling poles to the desired location, digging holes and after setting, tamping in the poles. The figures seem to be given in a very general way, with no idea of the size or type of pole given, and nothing said about the condition of setting, whether in country or town, class of ground, and the like.

"We have set quite a number of poles in north Georgia during the past few years, and by using a block and tackle method of our own design have been able to set a large number of 50 ft. creosoted poles in a day's time with a minimum number of men at a cost of 60 cents to 75 cents per pole. This figure, of course, does not include anything but actually setting and tamping in the poles. The cost of compiling the figures is negligible, as it required merely the scanning of a few daily field reports selected at random. We have used the block and tackle method referred to for a couple of years and employed a pair of mules and nine or ten men to set poles. Recently a 1.5-ton truck has been substituted for the mules and the services of six or seven men dispensed with. In other words, we are now setting from twenty-five to forty 50-ft. and 60-ft. creosoted poles, weighing approximately 2 tons each, in a day with three men and the truck at a cost which is approximately 33 cents per pole."

As an example of the basis for computing the costs of pole setting, a member of the Ohio Electric Light Association has furnished the following data. The costs given are for two lines built through a hilly country. The poles used are chestnut and vary in length from 45 ft. to 60 ft. The average length of the poles was 48 ft.

Number of poles	328	485
Labor per pole (hauling, trimming, setting and cross-arming)	$18.78	$15.88
Extra teaming (hauling men and material)	2.59	2.86
Miscellaneous	1.10	4.43
Insurance	.95	.78

"It will be noted that the miscellaneous charges in the second column of the table are rather high. This was due to the many causes that happen in the building of any transmission line occasioned by unforeseen difficulties, of damages and other difficulties that impeded construction work. These figures are meaningless to anyone not familiar with the type of construction. Chestnut poles of class 'A' specifications were used, which are nearer sawlogs than they are poles. Each pole was equipped with an angle iron bayonet and with two wood crossarms 4 in. by 5 in. by 8 ft. These in turn were equipped with three strings of suspension insulators five units per string."

CENTRAL STATION SERVICE

A Department Devoted to Commercial Policy and Management Topics, Including Applications of Electric Light, Power and Heat

IMPRESSIVE FIGURES THAT POINT VEHICLE OPPORTUNITIES

Present Investment of $36,000,000 in Electric Commercial Cars Means an Energy Consumption of 90,000,000 Kw.-Hrs. Per Annum

Some interesting figures on the possibilities of development of the electric vehicle were presented by W. P. Kennedy, consulting transportation engineer, New York City, in his address before the conference of central station executives held under the auspices of the Electric Vehicle Section of the N. E. L. A. at New York, Feb. 14.

There are now in daily use, said Mr. Kennedy, approximately 20,000 electric passenger cars (representing $40,000,000 investment) and each yielding a return of at least $100 per year for energy, or a total of $2,000,000. At least 75 per cent of these are used in the large cities where the garages and owners are restricted to the use of off-peak load.

There are in the United States fifty-four cities exceeding 100,000 population, each of which should absorb 100 electrics per annum. There are fifty-nine cities between 50,000 and 100,000 which should each take fifty. There are 133 cities between 25,000 and 50,000 entitled to twenty-five cars each. There are 350 cities from 10,000 to 25,000 which can readily use ten each.

This totals 15,225 cars per annum without including a host of small towns where electrics are gaining a foothold.

A yearly product of 15,000 cars would add $1,500,000 each succeeding year to the previous sale of energy. If this entirely reasonable accomplishment were carried out, the central stations of the country should within seven years receive collectively a total of $10,000,000

TABLE I—VALUE OF COMMERCIAL ELECTRIC VEHICLE EQUIPMENTS IN VARIOUS LINES OF BUSINESS

Brewers	$5 950,000
Department stores	5,927,000
Public service companies	4,171,000
Express and transfer companies	3,460,000
Manufacturers' and merchants' industrial trucks	2,700,000
Industrial manufacturers	1,374,000
*Railroad and steamship companies	1,200,000
Bakers	1,023,000
Packing house organizations	679,000
United States Government service	515,000
General trucking	510,784
Wholesale dry goods	400,000
Municipal apparatus	368 000
Storage warehouses	180,000
Retail grocers	170,972
Wholesale grocers	150,000
Food products	125,220
Coal merchants	120,000
Hospital ambulances	120,000
Hardware	116,000
Publishers	85,787
Glass	75,000
Paper dealers	64,235
Confectioners	63,840
Restaurateurs	60,450
Musical instruments	48,687
Silversmiths	38,550
Ice	30,580
Dairy products	30,220
Clothing—retail	28,545
Silk finishers	21,525
Oriental furnishings	19,080
Soaps	17.250
Carpets	16,840
Other miscellaneous applications	6,134,000
Total value of electric vehicle equipments applied to end of 1916 (approximate)	$36,000,000
Annual energy consumption (approximate) 90,000,000 kw.-hr., at 4 cents	3,600,000

*Including industrial trucks.

TABLE II—PRESENT AND POSSIBLE ELECTRIC VEHICLE LOAD VALUES IN VARIOUS CITIES, A LARGE PORTION OF WHICH MIGHT BE SECURED BY ADEQUATE EXPLOITATION OF THE ELECTRIC.

	Annual Load Value at 4 Cents per Kw-hr.
Baltimore:	
35 passenger electrics, at $100	$3,500
140 commercial electrics, at $300	42,000
17,173 horses, at $100	1,717,300
	$1,762 800
Boston:	
287 passenger electrics, at $100	$28,700
314 commercial electrics, at $300	94,200
23,000 horses, at $100	2,300,000
	$2,422,900
Chicago:	
3,000 passenger electrics, at $100	$300,000
1,050 commercial electrics, at $300	315,000
69,320 horses, at $100	6,932,000
	$7,547,000
Cleveland:	
1,750 passenger electrics, at $100	$175,000
115 commercial electrics, at $300	34,500
17,000 horses, at $100	1,700,000
	$1,909,500
Denver:	
750 passenger electrics, at $100	$75,000
43 commercial electrics, at $300	12,900
11,647 horses, at $100	1,164,700
	$1,252,600
Detroit:	
1,500 passenger electrics, at $100	$150,000
175 commercial electrics, at $300	52,500
13,921 horses, at $100	1,392,100
	$1,594,600
Hartford:	
300 passenger electrics, at $100	$30,000
95 commercial electrics, at $300	28,500
3,639 horses, at $100	363,900
	$422,400
Kansas City:	
876 passenger electrics, at $100	$87,600
90 commercial electrics, at $300	27,000
14,324 horses, at $100	1,432,400
	$1,547,000
Newark and Public Service Territory:	
295 passenger electrics, at $100	$29,500
331 commercial electrics, at $300	99,300
23,400 horses, at $100 (In Newark and Jersey City)	2,340,000
	$2,468,800
New York:	
450 passenger electrics, at $100	$45,000
2,800 commercial electrics, at $300	840,000
129,400 horses, at $100	12,940,000
	$13,825,000
Philadelphia:	
300 passenger electrics, at $100	$30,000
510 commercial electrics, at $300	153,000
51,800 horses, at $100	5,180,000
	$5,363,000
Pittsburgh:	
250 passenger electrics at $100	$25,000
49 commercial electrics, at $300	14,700
13,454 horses, at $100	1,345,100
	$1,385,100
St. Louis:	
590 passenger electrics, at $100	$59,000
116 commercial electrics, at $300	34,800
31,362 horses, at $100	3,136,200
	$3,230,000
Washington:	
800 passenger electrics, at $100	$80,000
250 commercial electrics, at $300	75,000
13,374 horses, at $100	1,337,400
	$1,492,400

NOTE: Allowance is made for the present horse population on the basis of an income of $100 per year for each horse displaced by electric transportation.

per annum from the sale of energy for electric passenger cars.

There are, however, at present, said Mr. Kennedy, only about four manufacturers of commercial cars and four manufacturers of passenger cars in the business. It is too much to expect that they have any resources which could be employed to do more than maintain their own subsistence.

The central station, therefore, must pass judgment upon the whole matter in an abstract way, placing reliance entirely upon the revenue value of the vehicle itself as a utility in the extension of its business.

There are five classes of energy-consuming apparatus which constitute the load builders of central stations: Lamps, motors, domestic appliances, electric automobiles, and in some cases street car systems.

A little analysis will show that the automobile is the most desirable of these, both from the quantity of energy consumed per unit, and the fact that energy is taken by this device when the others are not generally in use.

The value of the possible automobile load in any city at the present time may be measured by the number of horses in use, or by the number of horses that would be in future use, as required by the increasing business development in each community.

Each horse superseded by electric vehicles has an average revenue value of about $100 per year with energy at 4 cents per kilowatt-hour.

The average or medium size electric vehicle usually supersedes three horses, and is thus equal to $300 per annum at the same rate for energy.

The larger size vehicles consume $500 worth of energy per annum and few of the smallest size consume less than $200 worth per annum at the 4-cent rate.

As a large proportion of the horses in any given city could be superseded by a reasonable amount of exploitation, the load value which could be secured by the central station might therefore be measured by half, or even one-third, of the horses now employed at $100 per horse per annum.

There are very few medium-sized cities in which reasonable effort would not supersede 1000 to 2000 horses, and as this would mean 300 to 600 commercial vehicles, the value of this load may be readily computed at $300 per machine per annum.

In many of the larger cities there is on a possible development of from 30,000,000 to 50,000,000 kw.-hr. per annum, but to secure such an amount some effort of a different character from that already employed would certainly be necessary.

The question to be answered, declared Mr. Kennedy in conclusion, is what amount of effort should each central station expend in building up for itself a load of this character and volume as a new-business development?

Free Appliance Repairs in St. Louis

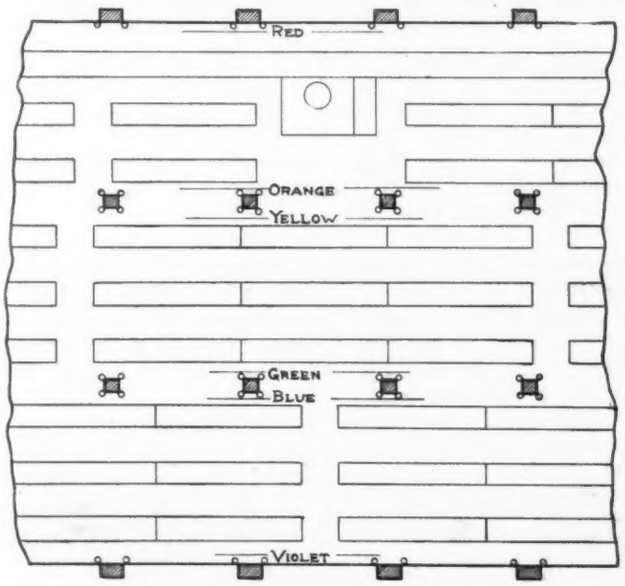
In the future when repairs to electrical appliances, which have been purchased from the Union Electric Light & Power Company of St. Louis and which are in use by the customers of that company, are necessary, it will be possible for the consumer to have the repairs made free of charge. By telephoning to the company's office-sales department, they can secure the services of a special appliance repair man, who will make the necessary repairs to the appliance on the customer's premises if possible. In case the necessary repair is of a more extended character, the appliance will be taken to the company's shop where the trouble will be remedied, after which the appliance will be returned to the customer without charge.

THE SPECIAL LIGHTING FOR THE EDISON DINNER

Ceiling Color Spectrum Projected from Concealed Reflectors—Dipped Lamps Burned at Overvoltage for Short Period

BY A. L. POWELL

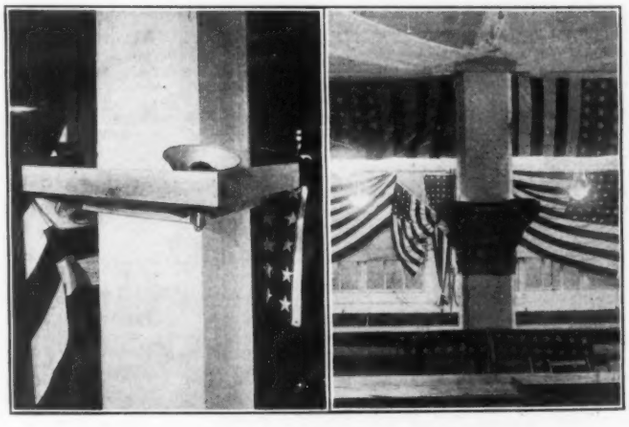
The lighting scheme employed for the dinner tendered to Thomas A. Edison by his employees on the occasion of his seventieth birthday was somewhat novel and warrants description. The gathering was held on the fifth floor of the Edison Storage Battery Company's building at Orange, N. J., the entire north wing and three bays



PLAN OF PORTION OF THE BANQUET HALL

of the east section being utilized to accommodate the large party, which numbered more than 1800.

The festivity of the occasion required that the decorations be in harmony with this spirit. The customary method of decoration is to employ quantities of colored bunting draped on every available point, with innumerable small lamps strung everywhere. Needless to say, the effects thus produced are often garish. In the case of the Edison celebration, however, a carefully planned arrangement of lamps caused the ceiling to take the appearance of a gigantic spectrum, although no colored trim was used save for a few American flags which were employed to hide the details of construction. The strips of white cheesecloth shown in the accompanying picture



DETAILED VIEW SHOWING METHOD OF SUPPORTING LIGHTING UNITS, AND PROVISIONS FOR CONCEALING SPECIAL CONSTRUCTION

were caused to assume an infinite variety of delicate tints, blending one into the other without lines of harsh demarcation.

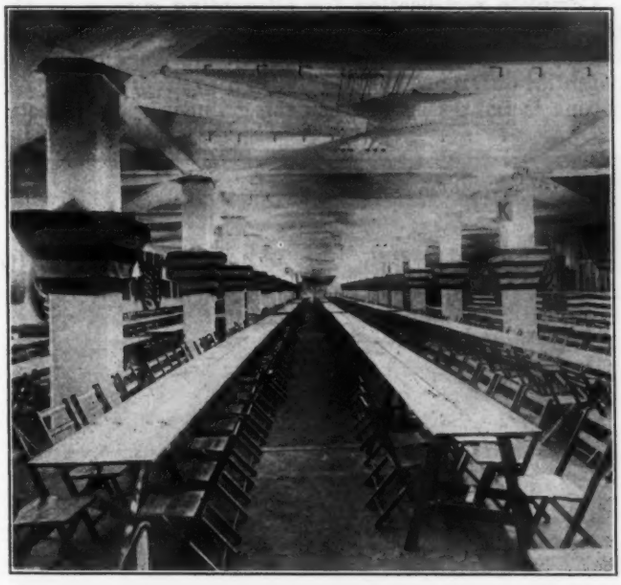
The illumination was exceptionally uniform, not a lamp was visible, and any shadows which were produced were extremely soft.

The building is of typical mill construction, with concrete pillars supporting a heavy beamed ceiling, and painted a flat white. The main room is three bays wide, posts being spaced 15 by 20 ft. As tables were placed throughout, uniform general lighting was required.

Certain conditions made it necessary to avoid the use of any fixtures suspended from the ceiling.

As it was but 12 ft. to the bottom of the beams, and the permanent outlets for general illumination were quite widely separated, it was decided to neglect these entirely and run special feeders for the decorative lighting.

After preliminary experimentation a totally indirect method of illumination was adopted. Seven feet from the floor a wooden framework, such as pictured in one



NIGHT VIEW SHOWING SPECIAL ILLUMINATION EFFECTS FOR MR. EDISON'S SEVENTIETH BIRTHDAY PARTY

of the illustrations, was provided at each post, and similar equipment on the corresponding pilasters. An angle reflector was placed in each corner of the box thus constructed. This was of steel with matt aluminum finish, 10 in. in diameter, 9½ in. deep, with the holder set at an angle of 45 deg. The general arrangement of these outlets is shown in the floor plan of a portion of the room. An American flag, neatly pinned in place around each framework, effectually concealed the reflectors, connections and construction work.

These groups of two and four units were connected in multiple by lamp cord and then attached to special feeders which were run lengthwise of the room in four pairs. The bushed holes, provided through the ceiling beams by the mill construction, enabled this work to be done neatly and with ease. A three-wire connection was used and the load balanced.

Flat streamers of white cheesecloth 30 in. wide were stretched diagonally from pillar to pillar. These were readily attached to strips of wood tacked around the top of each column. This slight decoration was deemed desirable to partly cover the rough appearance of the ceiling.

One hundred-watt vacuum-type tungsten lamps were adopted as the lighting units. These were superficially colored or dipped. This type of lamp was chosen as it was known that the coloring would not change during a period much greater than the lamps would be in service. As the installation was to be used for only a few hours, it was deemed advisable to burn the lamps over voltage. Accordingly, 100-volt lamps were used, although the circuit was approximately 115 volts. In this manner the light output was increased 60 per cent, which compensated to a great degree for the absorption of the colored dips. The power consumption was about 1.2 watts per square foot of floor area, this rather high wattage being necessitated by the loss of light due to coloring.

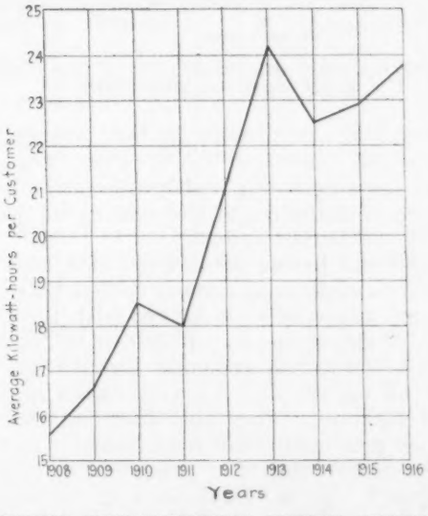
As indicated on the drawing, red, orange, yellow, green, blue and an approximate violet lamps were used in successive rows the entire length of the room. This arrangement made possible the spectrum effect desired. Careful selection was made of the colors used, in order that the most perfect blending might be secured.

The Edison band rendered selections from time to time and a special section of the east wing was provided as a band stand. It was thought desirable to provide a somewhat higher intensity in this area, in order that there might be no question as to the amount of light incident on the music. A white canvas was stretched over the stand and four semi-indirect dishes of dense opal glass, with 250-watt Mazda lamps hung pendant, were used here.

The possibilities of intelligently applied colored lighting are remarkable, the effects produced striking, yet dignified, and it is safe to prophesy that more and more of this work will be done.

Increase of Energy Consumption by Apartment-House Customers

Individual customers of the lighting companies are steadily being educated to use more current. The accompanying curve was plotted from data given by Peter Junkersfeld of the Commonwealth Edison Company in his address at the convention of the Indiana Engineer-



CURVE SHOWING HOW INDIVIDUAL ENERGY CONSUMPTION OF CHICAGO APARTMENT-HOUSE CUSTOMERS HAS INCREASED IN THE LAST EIGHT YEARS

ing Society at Lafayette, Ind., showing the average monthly consumption of apartment-dwelling customers in Chicago. In 1908 the number of apartment-house customers was 25,980, and since that time the number has steadily increased until in 1916 the total reached 168,234.

ADVANCE IN TECHNICAL THEORY AND PRACTICE

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CORONA PHENOMENA

Electric Strength of Air—The Corona in Air and Hydrogen—Applications to Rectification—Abstracts of Recent A. I. E. E. Papers

AT the New York meeting of the American Institute of Electrical Engineers last week two interesting papers were presented on corona phenomena. In one of these J. B. Whitehead and W. S. Brown discussed the electric strength of air. In view of the variation among the values obtained by different observers, the authors have carried out a careful determination of corona-forming voltages for alternating and for positive and negative continuous voltages in the same apparatus and under the same conditions. The principal result is that within the range of wire diameters used corona appears at a lower value when the wire is positive than when it is negative, although the two curves converge for increasing diameters. The maximum excess of negative over positive, as observed, was 6.3 per cent.

The values with alternating voltage coincide with those of negative continuous voltage. Positive continuous voltage, therefore, forms corona at the lowest value.

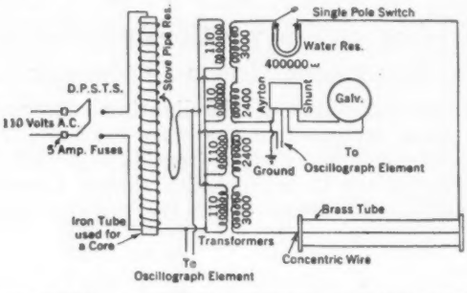


FIG. 1—CIRCUITS AND ARRANGEMENTS OF CONNECTIONS FOR HALF WAVE RECTIFICATION

These results of the present authors are at variance with the recent results of F. W. Peek, Jr., who had found that the alternating and continuous voltages are identical and independent of the polarity of the wire in the case of continuous voltage.

Whitehead and Brown pointed out that the fact that positive corona appears at a lower voltage than negative for the same size wire is in accord with the theory of secondary ionization due to collision, if we assume that the negative ion is the principal ionizing agent. Observations on negative corona give values higher than heretofore obtained. They also describe other experiments which give qualitative indications of the correctness of Townsend's theory of ionization by collision.

The paper by J. W. Davis and C. C. Breese discussed the corona discharge between co-axial cylinders (or between a wire and a concentric cylinder) in an atmosphere of hydrogen. The chief results of the investigation are as follows: The critical intensity for corona in hydrogen follows Peek's law fairly closely as far as changes due to variations in the gas pressure are concerned. The variation of the critical intensity with the radius of the wire is not as yet conclusively proved, either to follow or not to follow Peek's law, but the general character of the results so far obtained seem to indicate that the law may hold.

Hydrogen is different from air in that corona is maintained at voltages considerably lower than the critical voltage while this has not been found to be the case with air. The characteristic curves with the wire positive in hydrogen differ from those with air in that the voltage necessary to maintain a given current depends on whether that value of current has been approached by increasing or decreasing the machine voltage. The characteristic for the wire negative in hydrogen is entirely different from the characteristic obtained with a negative wire in air.

Complete rectification for alternating current is obtained between concentric cylinders when the intervening space is filled with hydrogen and an alternating potential difference sufficiently high to produce negative corona is impressed between the cylinders. This rectification continues after the negative arc has been established, under the proper conditions of pressure, size of wire and size of tube. Direct currents as high as 0.12 amp. have been obtained with alternating voltages of approximately 8000 volts.

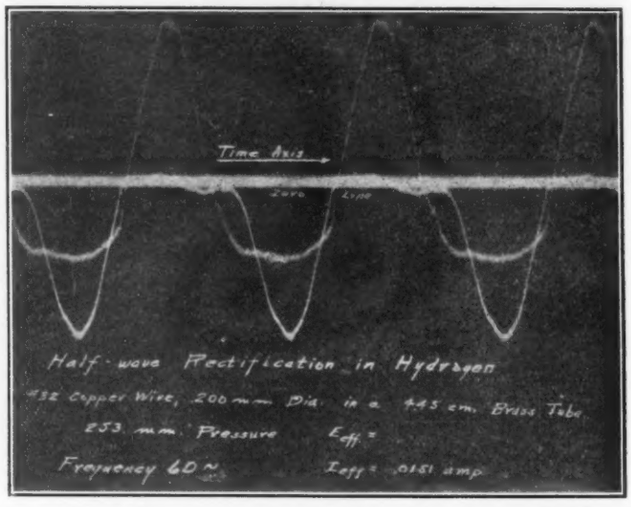


FIG. 2—VOLTAGE AND CURRENT CURVES WHEN ALTERNATING VOLTAGE IS IMPRESSED ACROSS A CORONA TUBE

The connections for half-wave rectification are shown diagrammatically in Fig. 1, which is self-explanatory. How effective a means of rectification the corona in hydrogen between a wire and a tube is may be seen from Fig. 2, which gives the current and voltage curves when an alternating voltage is employed and impressed across a corona tube.

The curve has both positive and negative lobes in the voltage. The non-symmetrical character of this curve is due to the drop in the resistance in series with the primaries of the transformers. The curve lying mainly below the axis represents the current flowing between the wire and tube. The irregularities in the part of the curve near the zero line seem to be due to the capacity effect and are in no sense characteristic of the corona discharge.

Generators, Motors and Transformers

Calculation of Three-Phase Motors.—KARL METZLER.—A mathematical paper on the stray-flux coefficient and the predetermination of three-phase motors. In the design of three-phase motors both the stray-flux coefficient and the overload capacity are important. The dimensions and the distribution of the windings can be chosen in such a way that the stray-flux coefficient becomes a minimum for a given overload capacity. The author gives a formula for determining the condition under which this takes place, and comments on analogous formulas of Pichelmayer and Hoock.—*Elek. Zeit.*, Dec. 28, 1916 (this is the first issue of *Elek. Zeit.* which has been received in this country for almost a year).

Lamps and Lighting

Lumen as a Measure of Illuminating Power.—An account of a discussion on this subject before the British Illuminating Engineering Society. Prof. J. T. Morris pointed out that the distribution of light from illuminants can now be carried so widely by the use of suitable globes and reflectors that the only proper basis of comparison is in terms of the total light in all directions. It has been suggested that lamps should be rated in terms of mean spherical candle-power, but this would involve giving most lamps a smaller rating than at present, which is inconvenient commercially. In addition, the mean spherical candle-power is an imaginary quantity, somewhat difficult of conception. British makers of electric lamps contemplate adopting the lumen, though it may be necessary also to state candle-power values and to show their relation to lumen values during the transition period. The use of the lumen in connection with illuminating engineering calculations has several advantages. For example, if the lumens in each zone from a lighting unit are tabulated, the addition of these values gives the total output of light; *i.e.*, the total flux of light produced by the unit; this can be compared at once with the corresponding output in lumens of the lamp used in the lighting appliance (globe, reflector, etc.), and the efficiency of the latter readily ascertained. It is also convenient to work with lumens in the usual formulas for determining the average illumination in a room resulting from a given arrangement of lamps, and particularly when the approximate average illumination over an area needs to be quickly determined. It also assists calculation of the illumination derived from extensive illuminated surfaces, such as occur in the case of indirect lighting. F. W. Willcox, who followed, illustrated the diversity in polar curves of light distribution of modern illuminants by a large number of diagrams. He also recommended the adoption of the lumen. Although at first unfamiliar, the general use of this method of rating will ultimately be much more convenient. Besides being the most scientific basis of comparison, the use of the lumen will simplify the formulas used in calculations. The simple equation for determining the number of lamps required to light a given area is the product of the floor area in square feet and illumination in foot-candles divided by the product of "utilization efficiency" as a decimal and lumens per lamp. The utilization efficiency is a factor depending on the arrangement and type of lighting appliance used. It will remove several opportunities for misunderstanding and misrepresentation which arise through statements of the candle-power from lamps in a single direction only.—London *Electrician*, Jan. 26, 1917.

Tungsten Arc Under Pressure.—GEORGE P. LUCKEY.—An account of an experimental investigation carried out at the Nela Research Laboratory. Measurements were made of the temperature of the melting point of tungsten in the electric arc under pressure from 1 to 30 atmospheres. The melting point found at 1 atmosphere was 3623 deg. K., and the apparent melting point decreased to 3564 deg. K. when the pressure was raised to 28 atmospheres. It is doubtful whether this decrease is due to a change in the melting point or merely to an increased absorption of the vapor surrounding the arc. The highest temperatures attainable in the arc were measured, and a large increase in this temperature as the pressures increased was noted. At atmospheric pressure a probable temperature of 4235 deg. K. was found, while at 33 atmospheres the highest temperature in the arc was increased to 5084 deg. K. It is probable that these temperatures represent a value somewhere between the melting and the boiling points of tungsten in each case. The electrical characteristics of the tungsten arc were investigated. The drop in potential across the arc, other conditions being the same, was found to increase with the pressure. At high pressures the voltage dropped as the current increased until values of current of about 5 amp. were reached, after which the voltage rose with increasing current. This latter effect might be ascribed to the tendency of the arc to flare out to one side with larger currents, as well as to the increase of pressure in the tank caused by the heating of the gas.—*Phys. Rev.*, February, 1917.

Generation, Transmission and Distribution

The Future of Water Power in the United States.—CHARLES W. COMSTOCK.—The author gives a careful compilation of figures showing the total fixed installed primary power in the United States and similar figures for total installed water power, at the same time calling attention to the unreliability of statistics in general. With these figures, those compiled by the Commissioner of Corporations are summarized and compared. The geographic distribution of installed water power is considered, and it is pointed out that while the percentage of total central station power generated by water is only 21 and 22 per cent for the New England and the Middle Atlantic States, it is nearly 60 per cent on the Pacific Coast. The three Pacific Coast states, with 4.6 per cent of the population, have 12.3 per cent of all the central station power in the United States. Of this, nearly 60 per cent or 7.2 per cent of all central station power in the country is hydroelectric. In discussing the advantages of water power developed the author points out the fallacy of power development waiting upon demand instead of creating it. The immense field for hydroelectric power which a development of the electrochemical and electrometallurgical industries would create with the success of such industries abroad is cited and an appeal made for a federal policy of encouraging business enterprise instead of obstructing it.—*Proceedings* Amer. Inst. Elec. Engrs., January, 1917.

Traction

Regenerative Breaking.—R. E. HELLMUND.—The author discusses the problems of applying regenerative breaking to electric railways. He discusses three-phase systems, the phase-converter system, the direct-current systems, the alternating-current commutator-motor systems, and the possibilities of regenerative control with a vapor converter system. He thinks that in view of the practical advantages of regeneration for heavy railroad work, it is quite likely that regeneration will in time become one of the factors which will win some railroads, now operated by steam, over to the electric cause.—*Proceedings* Amer. Inst. Elec. Engrs., January, 1917.

Electromobile Experience.—R. BORLASE MATTHEWS.—An account of the experience with electric vehicles of the Hartford Street Motor Company, Ltd., which houses as many as 120 electric vehicles in its garage. The

author discusses the advantages of the electric vehicle, care of batteries, battery life, interchangeability of batteries, value of good discharging, battery ills, overcharging, operating systems, battery details, car particulars, garage arrangement, and costs.—London *Elec. Rev.*, Jan. 19, 1917.

Electrophysics and Magnetism

The Actinium-Uranium Ratio in Colorado Carnotite.—KARL H. FUSSLER.—An account of an experimental investigation in which the ratio of activity of the actinium series to the activity of the uranium associated with it in Colorado carnotite was determined. The results indicate that the quantity of actinium in carnotite is proportional to the quantity of uranium. The value of the ratio is of the same order of magnitude, but somewhat lower than that obtained by Boltwood using North Carolina uraninite. The results are in agreement with the theory that actinium is a branch product of the uranium series.—*Phys. Rev.*, February, 1917.

Units, Measurements and Instruments

International System of Electric and Magnetic Units.—J. H. DELLINGER.—A critical discussion of the present international system of electric and magnetic units and of various proposed changes. The electric units ordinarily used are based upon certain standards defined by international congresses. These units may be considered to form a distinct system. They have been called international units to distinguish them from the corresponding units in the electromagnetic system, of which they are the representatives for the purpose of electrical measurements. The international and the electromagnetic units differ by exceedingly small amounts, and the small differences are determined by absolute electrical measurements made from time to time. The international system takes the international ohm, the international ampere, the centimeter, and the second, as fundamental units. The unit of magnetic pole strength is relegated to a subordinate position, corresponding with its unimportance in practical work. The dimensional expressions of electric and magnetic units in this system have a simplicity and direct applicability lacking in other systems. The system has, however, no such simplicity or utility in the domain of mechanics nor anywhere except in electricity and magnetism. It in no way tends to supplant the classical system based on length, mass and time. Magnetic units have been in a somewhat confused state. The use of the word "gauss" as the name for both the unit of induction and the unit of magnetizing force is one difficulty. The international system furnishes no justification for this double usage. There have been various proposals from time to time to rationalize the electric and magnetic units; that is, to use units such as to redistribute the factor 4π in the equations. In no systems is this factor entirely eliminated. The first proposal, that of Heaviside, had much to recommend it and his units are used in some recent theoretical works. However, all the units are different by some power of 4π from the ordinary units, and their general adoption now seems out of the question. Proposals since Heaviside's for the rationalization of the units have involved less change of existing units, but have all had the disadvantage of incorporating 4π in the values of the permeability and dielectric constant of empty space. A very satisfactory rationalization is effected by the use of the ampere-turn as the unit of magnetomotive force, without recourse to any new units. There are two sets of magnetic units in use, based upon the international electric units. In one set the units correspond in magnitude to the ordinary cgs electromagnetic units. In the other, the ampere-turn and derived units are used. For want of a better name, the units of this set are called ampere-turn units. It has been pointed out that the ampere-turn units are rationalized more nearly like the Heaviside units than any of the systems which have been proposed, in that μ_0 retains its value unity. From one standpoint the 4π are even better distributed than in the Heaviside system. It is of interest to find that units actually in use constitute a system which is not at all inferior to the various proposed systems. In conclusion, this study has shown that the international system, based upon and representing the electromagnetic system, is a convenient and satisfactory system of units for the purposes of electric and magnetic measurements. Proposed changes in some or all of the units do not appear to offer advantages such as to justify the inconvenience of changing the units as ordinarily used.—*Scient. Paper, Bureau of Standards*, No. 292, Oct. 11, 1916.

Use of Thermocouples at Temperatures Above the Melting Point of One Constituent.—C. R. DARLING and A. W. GRACE.—A brief abstract of a (British) Physical Society paper on the thermoelectric properties of fused metals. One of the authors has for some time been investigating the possibility of using base metal thermocouples at temperatures above the melting point of one of the constituents. For this purpose it was necessary to determine whether any peculiarities in the thermoelectric behavior of metals occur at fusion. In the case of lead, tin, zinc, and cadmium there is no perceptible break in the continuity of the curves obtained. In couples containing bismuth, however, several cases were noted in which the emf. remained constant for a wide range of temperature after the fusion of the bismuth. This occurs with silver, aluminium, iron or nichrom as the other element. Useful applications of this property are discussed. No attempt was made to construct a thermoelectric diagram from the results, as it would be impossible to obtain correct values of dE/dt at all parts of the curves, many of which show small flexures, without making more accurate measurements in the region of such flexures than was practicable.—London *Electrician*, Dec. 29, 1916.

Miscellaneous

Expiring British Patents.—A list giving the principal British electric patents which will expire during 1917. In an editorial note it is pointed out that the list this year does not include as many patents of general interest as is frequently the case, but, on the other hand, there are some of more than usual importance. Among these may be mentioned No. 322 of 1903, which describes at considerable length the various mechanical details of the Edison accumulator, which have gone a long way towards securing the success which this cell has achieved. Apart from the details the specification does not refer particularly to the electrodes or the chemical actions underlying the electrochemical action of the cell. Patent No. 3704, by Messrs. O. S. Bragstad and J. L. LaCour, describes the well-known motor converter, consisting of a combination of a synchronous machine and a rotary converter mechanically coupled together, the phases of the motor being connected in concatenation with equidistant points of the armature winding of the rotary. The resulting advantages are easy starting with alternate currents and a saving of material. Patent No. 15,599, due to V. Poulsen, describes the well-known development of Duddell's arc by placing it in hydrogen or in a hydrogen compound, so that higher frequencies are obtained, thus enabling the arc to be used for radio-telegraphic work. Lastly, Patent No. 24,305 describes Sir Oliver Lodge's system for the deposition of fog and dust by means of rectified high-tension alternating currents.—London *Electrician*, Jan. 5, 1917.

Book Reviews

LA CHIMIE DES ELEMENTS RADIOACTIFS. By Frederick Soddy. Paris: Gauthier-Villars, et Cie. 174 pages. Illustrated. Price, 5 francs. E. Phillippi, Translator.

This is a good translation from the English original into French of a very interesting text-book on the chemistry of radioactive materials.

Radioactivity is only twenty years old, for it was discovered by Henri Becquerel in 1896. Yet in this relatively short space of time it has profoundly modified human philosophies and the fundamental beliefs of educated mankind. Owing to radioactivity, the conservation of matter is no longer believed in. The old belief has been shelled out of the scientific curriculum by projectiles believed to be but little more massive than the 2000th part of a hydrogen atom.

The book has no chapters but is divided into two sections, the second dealing with the more recent developments of this wonderful subject. The treatment is emphasized from the chemical standpoint, and the physics of the subject are left to a subsidiary category. Tables and diagrams are given of atomic weights of the chemical elements from the radioactive point of view, adopting a modified Mendeljeff tabulation.

Only specialists can hope to be familiar with the details of a subject which specializes specialization; but no intelligent person can claim to be educated to-day who does not know something about the elements of radioactivity, whether he obtains his knowledge from the English; or, in this case, from the French language.

ELECTRICAL ENGINEERING. First Course. By Ernst J. Berg and Walter L. Upson. New York: Mc-Graw-Hill Book Company, Inc. 416 pages. 295 illustrations. Price, $4.

So many good books have been written on electrical engineering and design of machines by so many prominent engineers that the reviewer is at a loss to know just how appropriately to compare one with the other or offer an opinion on the merits of any particular one. Perhaps this thought may be more clearly expressed by saying that the existing widely accepted works appear to the reviewer as different designs of beautiful architecture—different mainly because they are put together differently but all serve the same purpose. From the frank admission of the authors in their preface that no book on electrical engineering can now be produced which does not bear testimony to the pioneer work of such writers as Fleming, Silvanus Thompson, Bedell and Crehore, Steinmetz and McAllister, it is certain that they appreciated this situation when looking for an excuse on which to hinge the offering of the book. Be this as it may, the authors are to be congratulated on the production of another fine piece of work, a textbook that will stand close analysis and be found concise, but comprehensive, devoted to fundamentals but intensely practical and understandable, not a mathematical treatise on theory but a useful textbook or reference. It is another new book of the type that the reviewer believes should be in every well filled, well balanced engineering library, one to refer to for an hour's review of engineering fundamentals with an author who thinks and reasons in the light of the latest research and in the language of the latest standards.

The book contains forty-five chapters. The first twenty-five chapters are devoted to the fundamentals of the magnetic and electric circuit and the design of direct-current machines. The remaining chapters are devoted to discussions of the principles on which alternating-current apparatus is constructed and operates. The entire book is well illustrated with circuit diagrams, curves and vector diagrams with practically no space taken up with pictures of machines that can be secured from manufacturers' catalogs showing all types, forms and styles. The elimination of this character of illustration is altogether wise, since it prevents the student from picturing in his mind a certain form of machine, when discussing the theory on which a group of machines operate, and to which fundamental principles apply equally or slightly modified. We hope this work will receive the attention and study it merits.

GAS ENGINE IGNITION. Prepared by Earle B. Norris, Robert K. Winning and William C. Weaver. New York: McGraw-Hill Book Company, Inc. 174 pages. 209 illustrations. Price, $1.50.

There is considerable information to be found on the subject of gas engine ignition in standard textbooks which take up the operation of the internal combustion engine, however most of these delve into the theory of the subject. The authors of this book have followed a most practical plan by combining the theory of the subject with descriptions, diagrams and illustrations of the different types of commercial devices that make up a complete ignition system. While changes in design of the apparatus shown are sure to come, the features of the devices shown, illustrate principles of operation and therefore aid in securing a thorough understanding of the fundamentals so that any reasons for the refinements in design and operation of modified devices will come easily to the student of the book. On account of this treatment it is not a work that will become antiquated. If for no other reason, the work should appeal to the practical internal combustion engineer by reason of the information on high-tension outfits and batteries. The work is not adapted to the needs of the designer but more especially to those of the student and practical repair man, as will be noted from the headings of the chapters which deal with operating features: The Make and Break System; Jump-Spark Battery System; Non-Vibrating Coils; Batteries; Low-Tension Magnetos; Oscillator Magnetos, Inductor Magnetos; Low-Tension for Jump Spark Ignition; High-Tension Magnetos; Direct-Current Generators; Miscellaneous Ignition Systems.

THE PRINCIPLES OF ELECTRIC WAVE TELEGRAPHY AND TELEPHONY. By J. A. Fleming. New York: Longmans, Green & Company. 912 pages. Illustrated. Price, $10.

This excellent treatise on the principles and apparatus employed in radio-telegraphy and telephony here appears in its third edition.

The chapter which in the preceding editions dealt with the history of the subject has been curtailed, and an interesting new chapter has been added on radio-telegraphic transmission.

There are ten chapters dealing respectively with the following topics: The production of high-frequency currents and electric oscillations, High-frequency electric measurements, Damping and resonance, Stationary electric waves on wires, Electric radiation, Detection and measurement of electric waves, The apparatus of electric-wave telegraphy, Radio-telegraphic stations, Radio-telegraphic transmission, Radio-telephony. They are all particularly strong on the quantitative side.

The book has been carefully revised and brought up to date. It offers to the student of the radio-communication principles what is probably the most complete and comprehensive treatise in the English language.

MANUAL FOR ENGINEERS. By Charles E. Ferris. Knoxville, Tenn.: Tennessee University Press. 220 pages. Price, 50 cents.

This manual, now in its twentieth edition, contains many valuable tables and other data for engineers and business men. Area, circumference, squares, cubes, root and logarithm tables are given, as well as tables of especial interest to the electrical, mechanical and civil engineer. The N. E. L. A. instructions for resuscitation from electric shock are also given. This book is not too bulky to carry in the pocket and shows careful work in the selection of data and in its makeup.

TELEPHONE APPARATUS. An Introduction to the Development and Theory. By George D. Shepardson. New York: D. Appleton & Company. 338 pages. 115 illustrations. Price (to come).

This is a textbook on telephonic apparatus, and especially on telephonic receiving and transmitting apparatus. It is developed with particular attention to the scientific history and literature of such apparatus. The wealth of references given to the technical literature in discussing the principles and modes of operation of telephone apparatus would justify the publication of this book without any regard to the matter contained in the text. The text is, moreover, well arranged and amply illustrated for the treatment of the subject.

The book is divided into four parts, which deal respectively with speech sounds, signaling equipment, sources of electromotive force and appendices containing mathematical sections.

The book is particularly well adapted for those who desire to acquaint themselves with the behavior of telephone apparatus and with the literature of the same. The mathematics in the text are simple, so that the book can be read by non-mathematical students. As a treatise on the subject it embodies not only experimental contributions and a good exposition, but also a large amount of systematic compilation.

ANNUAIRE POUR L'AN 1917. Publié par de Bureau des Longitudes. Paris: Gauthier-Villars & Company. Price, 2 francs.

This little red book has been annually republished by the French Longitude Office for the last 120 years. It is an admirable piece of national work, containing a large amount of information at a very low price. It has gradually grown in size, until since 1905 it has had to be divided, each half appearing successively in alternate years. This year it is the turn of the astronomical, meteorological and metrological half. The tabular data concerning calendars, the solar system, the stars, spectroscopy, metrology and meteorology are particularly developed. All these data are officially recognized among the scientific bureaus and societies of France. Certain astronomical charts of the heavens appear for the first time.

Following the 452 pages of regular text are 190 pages of special appendices. One of these appendices, by M. J. Renaud, is a valuable historical compendium of the actions in France which led last year to the legal adoption of the daylight-saving hour change in clock time. The principal debates and arguments on this subject are amply reported here. This document is of great importance to Americans, in view of the agitation for the same action in the United States this year. Another appendix, by M. M. Hamy, describes the determination of the international meter in wave lengths of cadmium red light. This measurement was first made by Michelson fourteen years ago. A recent redetermination is here reported. It appears that whereas Michelson made the meter 1,553,164.02 of these wave lengths, the redetermination makes it 1,553,164.13 or 1 part extra in some 15,000,000.

Perhaps for the first time the Annuaire contains portraits of two distinguished engineers and scientists.

The geographical section devoted to the geography of France is omitted this year for reasons that are self-suggesting, and in which we sympathize. We hope that at the next date of republication these difficulties shall have been removed.

PRINCIPLES OF ELECTRICAL DESIGN. D.C. and A.C. Generators. By Alfred Still. New York; Mc-Graw-Hill Book Company, Inc. 366 pages. 145 illustrations. Price, $3.00.

There are a number of good text-books that discuss the fundamental principles of electrical machine design but few that have been developed from as thoroughly a practical standpoint as the one by Professor Still. The author has confined himself mainly to the design of direct and alternating-current generators devoting about two-thirds of the book to the former and the last third to the latter, the first two chapters being given over to the magnetic circuit and electromagnets. Although this work has been designed primarily as a text for classroom work, the practical viewpoint explained by the author in an elaborate introduction and found throughout the development of the subjects treated, gives a logical reason for the book and sets it apart from the usual run of college texts. He says, "In the method of design as followed in this book, an attempt is made to base all arguments on scientific facts and build up a design in a logical manner from known fundamental principles. This is admittedly different from the method followed by the practical designer, who uses empirical formulas and 'short cuts' justified only by experienced and practical knowledge. It must not, however, be supposed that a commercial machine can be designed without the aid of some rules and formulas which have not been developed from first principles, for the simple reason that the factors involved are either so numerous or abstruse that they cannot be all taken into account when deriving the final formula or equation. In any case the constants used in all formulas, even when developed on strictly scientific lines, are invariably the result of observations made on many actual tests, such as the coefficient of friction, magnetic reluctance and eddy current loss are subject to the variation under conditions which it is difficult to determine. The formulas used in the design are therefore frequently empirical, and they yield results that are often approximations only; but an effort will be made to explain, whenever possible, the scientific basis underlying all formulas used in this book."

This explanation we believe, which the text bears out admirably, removes the book from the strictly college text book class and makes it become at once a practical reference text for the practical electrical engineer and designer who desires an aid in the interpretation of the problems which he meets in his work. The numerical examples and calculations throughout the text help to make it readable. The subjects treated and appear as chapter headings follow: Magnetic circuit-Electromagnets; Design of Electromagnets; Dynamo design—brief outline of the problem; Armature Windings and Slot Insulation; Losses in Armatures—Ventilation, Temperature Rise; Flux Distribution over Armature Surface; Commutation; Design of Field Magnets; Design of Continuous Current Dynamo—Numerical Example; Design of Alternators; Armature Windings, Losses and Temperature Rise; Air-gap Flux Distribution—Wave Shapes; Regulation and Efficiency of Alternators; Example of Alternator Design.

Readers' Views and Comments

Protecting Cable Sheaths in Manholes

To the Editor of ELECTRICAL WORLD:

SIR: The protection of cable sheaths from external damage is of greater importance to-day than ever. The size of cables and the capacity behind them is increasing, while the impedance to prevent the rush of heavy current is reduced. The congestion of the manholes, the large number of important cables in close proximity to one another all serve to emphasize the need for reliable protection. The matter of protecting cable sheaths is an old one, but the interesting article by Albert F. Hovey in your issue of Nov. 18, 1916, page 1009, raises several points which it seems might be discussed to advantage generally. Cement or asbestos coverings are the most generally used, although shelves of concrete, or split tile made from the duct conduit, are also quite frequently made use of.

There are a number of disadvantages in the use of asbestos in any of its forms however wound and whether used alone or with silicate of soda. Asbestos has not very high mechanical strength, and may for this reason be unfit for its task at the very time it is most needed. Pure asbestos has very high heat-resisting properties, but after lengthy service, especially in dirty, hot and moist locations, such as exist in the majority of manholes in large cities, the asbestos soon becomes affected and its value as a protective coating is greatly reduced, and to such an extent that it is easily torn and ruptured at the slightest provocation. The use of steel tape as a wrapping tends to prevent its injury, but the use of steel, in itself, is undesirable for several reasons.

Apart from its lack of mechanical strength detracting from its value as a protecting covering, asbestos has one further disadvantage, and a very real one. It appears to hasten rather than to mitigate electrolytic corrosion of the lead sheath. This action is very slight, if present at all, in dry localities, but is quite pronounced where there is moisture, and particularly in the presence of stray or vagabond unidirectional currents or direct currents from electric street car tracks and other sources. The exact manner in which the asbestos hastens corrosion does not appear to be known, but is apparently due to decomposition of the asbestos in which is included of course the absorption of the various salts and substances contained in the soil by absorption and cathodic action.

While cement appears to have many advantages over asbestos, it does not appear to be altogether free from corrosive action upon the lead of the cable sheath. Such action while slight has been discovered in several instances. The corrosive action appears to occur only in wet places or damp locations, and when in the presence of electric currents, which is a typical condition in city underground systems. In dry locations it is possible that the cement does actually exert a protective influence against electrolysis, because of its high ohmic resistance when dry. That electrolytic decomposition may be going on under cement coverings is a fairly recent discovery, and as yet no decided theory has been advanced which definitely answers the problem. The most obvious reasoning is that cement contains lime. In the presence of electrolytic action with current flowing from ground to lead these stray currents tend to decompose the lead in the cement until the lime exists in the free state, and next to the lead. When the cable sheath becomes positive, and the direction of current flow is reversed, this lime which existed in the free state has a tendency to dissolve the lead of the sheath. In practice there are always present acids diffused in the cement from the soil, the sewers, the dissolved products of illuminating gas, etc., which undoubtedly tend to hasten electrolytic decomposition.

The use of paraffined cheesecloth, as suggested by Mr. Hovey, would appear to have an added advantage over that mentioned by him, namely, that by inserting it between cable sheath and cement it tends to reduce electrolytic action by reason of its insulating properties and being non-hygroscopic. On the other hand the presence of paraffine and cheesecloth, which make rather a combustible working pair, might also be a real disadvantage in case of manhole fires.

While electrolytic action cannot apparently be avoided altogether, it is possible to reduce it by using cement instead of asbestos. If the cable sheaths are bonded properly and then grounded there appears to be little need for going to the expense of installing cable racks with their rather extravagant space factor, because the circuit through the supports for the cables are always in parallel with the bond wires at all times, and the path for the current through the supports is one of much higher resistance than that through the bond wires because in it are included the resistance of the cement coverings and the brick or cement walls of the manhole.

Bonding cable sheaths not only tends to prevent electrolysis and disintegration of the lead with eventual failure, but doing so also may prevent serious and even disastrous burn-outs. On high-capacity cables an arc may exist without the operators in the station knowing, because the current is limited by the comparatively high-resistance path along the cable sheath, and the overload relays cannot operate. Were the cable sheaths bonded together and grounded this current would reach a value sufficient to operate the relays. A number of very serious fires would have been prevented by judicious bonding of cable sheaths.

GILBERT RUTHERFORD.

Evanston, Ill.

A Mistaken Economy

To the Editor of ELECTRICAL WORLD:

SIR: This is essentially an age of big things, big business, big feats, big undertakings and big calamities. There is an old saying that "if we look after the little things the big things will look after themselves," and this surely never applied with greater force than in the operation of our large electrical systems, where the capacities to be controlled are enormous and the factors entering into its distribution complicated in the extreme.

When a large turbo-generator was recently installed in one of the famous power houses, a discussion took place as to which of two types of oil circuit breakers should be installed. The one type was admittedly preferable to the other because of a certain operating mechanism which possessed a safety feature. Its cost was, however, $4 more than the other and less desirable type. Moreover, the circumstances under which the protective device represented by the extra $4 in cost was intended to care for was an abnormal occurrence which, those of economical turn of mind contended, would probably never happen. The result was that eventually it was decided to save that $4 by foregoing that adjunct which might under somewhat remote circumstances be required.

Not long after the turbo-generator and its control apparatus had been placed in service trouble occurred in the generator end of the unit. Instead of the oil switch letting go it remained closed and thus the damage instead of being merely that due to the machine itself was made more extensive and disastrous by the reversal of power from the station bus, which continued until the defective generator could be cleared by hand control instead of automatically, as should of course have been the case.

With the large turbo-generator out of service it was necessary to operate two smaller units in its place until such time as repairs could be executed on the large one, and this machine restored to service. These smaller units required a greater coal and steam consumption per kilowatt-hour, due to lower efficiency of the turbine and generator, the smaller boilers, etc., and the cost due to operating these two smaller units until the large machine could be placed back in service again was $30,000 in excess of what it would have been had the large unit remained in service. To this expense should be added the cost of repairing the large machine, which required gangs of men working night and day as well as the cost of materials. Moreover, while the generator was having the damaged coils replaced, other construction men were taking out the oil circuit breaker and replacing it with the one which cost $4 more. In reality it had cost considerably in excess of $30,000 if labor be included. Assuredly, if the little things are properly attended to the big things may look after themselves.

R. I. ELKIN.

New York City.

NEWS OF THE INDUSTRY

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

ONE-HUNDRED POINT CONTEST WINNERS

Cleveland Winner in Cities of First Class, Milwaukee in Second Class and Eau Claire in Third Class

Winners in the Jovian Order "One-hundred Point Committee" contest that have been decided to date are for the three cities as classified according to membership. Cleveland, Ohio, is winner in the first class, J. M. Bateman, chairman; Milwaukee, Wis., winner in the second class, Carl Golin, chairman; Eau Claire, Wis., winner in the third class, A. E. Peirce, chairman. The prizes awarded are loving cups of over $100 value. The five winning state chairmen are, Roy M. Van Vleet, Milwaukee, Wis.; J. F. Dostal, Colorado Springs, Col.; O. A. Rofelty, Minneapolis, Minn.; H. E. Musson, Oklahoma City, Okla., and J. E. Taylor, Kansas City, Kan. To these Jovians the prizes awarded are Jovian rings and honorary Vulcan Degrees. The work of deciding the winners of local chairmen and committeemen has not yet been completed.

TO RAISE $50,000 FOR N. E. L. A. PUBLIC POLICY WORK

Plans Developed for Greater Activities Along Directions That Were Followed by Committee During 1916

Plans for greater activities by the public policy committee of the N. E. L. A., W. W. Freeman chairman, have been made and the Class A membership notified of the additional assessment of one-twenty-fifth of 1 per cent of the annual income necessary in order to carry out these plans. No expenditures will be made by the committee until a minimum sum of $50,000 has been assured for this purpose.

During 1916 the committee had under consideration the questions of (1) compiling data on the rulings of commissions in the various states; (2) valuation terminology; (3) proper methods in determining valuation; (4) compilation of rates and rate data; (5) information as to municipal ownership and operation; (6) information as to municipal ordinances and franchises; (7) water-power regulation and legislation; (8) regulations affecting inductive interference in transmission lines. In addition to the above, numerous other matters of importance to the central station business in general.

A conference of Class A members on these subjects was held in New York on Feb. 16 and 17, 1916, when these various matters were fully discussed. It was the consensus of opinion of the executives of the industry in attendance at this meeting that the activities of the association should be enlarged at as early a date as possible to secure the compilation of reliable information upon all of these subjects for the use of the member companies. At the public policy meeting held as an executive session during the Chicago convention of the association in May last the action of the conference held in New York was commended and the committee was definitely authorized and instructed to proceed to establish the necessary organization for meeting the needs of the member companies in connection with any of the matters mentioned or any other matters deemed of sufficient importance by the committee.

Acting upon these instructions, it was necessary to determine how this could best be done, and as the present income of the association is used entirely for the maintenance of its correspondence staff at headquarters, the activities of the various technical committees of the association and the general operations of the annual conventions, the committee states that it is necessary, in order to carry on this enlarged work properly, that the member companies be assessed pro rata, based on their general commercial electric income, excluding merchandise and railway business, on the basis of one-twenty-fifth of 1 per cent of such annual income.

The committee believes that it will take five years to cover the work that should be done.

STILL PROSPECTS OF PASSAGE OF WATER-POWER BILL

House Rescinds Vote to Discharge Conferees, Thus Having Effect of Bringing About Further Conference with Senate Conferees

The House of Representatives has rescinded its action of last week when it voted to discharge its conferees on the general dam bill. The conferees of the House had reported, and the Senate had also reported, last week, a hopeless disagreement on that measure. The Senate reappointed its conferees, and the action of the House, which took place Tuesday, has the effect of bringing about further conferences, with a view to trying again to reach an agreement.

The general dam bill passed both houses of Congress at the last session, in different forms, but the conferees have been unable to get together on it at this session. Representative Adamson, who has had the bill in charge for the House, as the chairman of the conferees, has had frequent conferences with President Wilson, who is strongly urging action on the bill at this session. There is now, therefore, a prospect that the bill will be passed at this session, although how good that prospect is no one in Washington will venture to say.

The Secretary of the Interior has designated, as actual or prospective valuable water-power lands, 750,000 acres along the Colorado River and other streams in Arizona. Practically all of this land is within the limits of national forests, monuments or Indian reservations, and will be affected by the bill in the Senate known as the public lands water-power bill, if that bill passes, although there has not been much prospect of its passage recently.

President Wilson has restored for settlement purposes 60,000 acres of land along the Bill Williams and Santa Maria rivers in Arizona. It had been withdrawn for investigation as to its water-power value but has been found worthless for water-power purposes.

PROPOSED CHANGES IN NATIONAL ELECTRICAL CODE

Recommendations of Electrical Committee of National Fire Protection Association on Code Changes to Be Considered at March Meeting in New York City

The important suggested changes in the National Electrical Code which were formulated by the National Fire Protection Association electrical committee and which will be considered at its meeting on March 28 and 29 in New York City are abstracted in what follows here. The reports refer to such matters as have been brought to the attention of the various committees and which were considered of sufficient importance to require special investigation and report.

WIRING OF POWER AND SUBSTATIONS

2. *Conductors.*

Sec. a.—Conductors installed in conduit or ducts where exposed to moisture must be lead sheathed and the sheathing must be grounded. Except for low potential systems the insulation of the several conductors where leaving the metal sheath of cables must be thoroughly protected from moisture and mechanical injury by means of a pothead or some equivalent method.

5. *Lightning Arresters.*

Sec. c.—Ground wires must not be attached to gas pipes within the buildings nor to be run inside of iron pipes unless electrically connected to both ends of such pipes.

Sec. b.—Arresters on circuits of over 7500 volts must be well isolated from all other equipment and if of the oil immersed type must be located outside or in a fireproof room or compartment on the premises.

11. *Transformers.*

Sec. a.—For oil cooled transformers used in stepping voltage up or down before distribution, a separate fireproof building, room or compartment is usually required, cut off from the plant proper, provided with not less than 6-in. non-combustible sill at doorway and with floor drained to some convenient point outside the building. Transformers of the air cooled type should be isolated from all other equipment and if of air blast type should be supplied with air through fireproof ducts.

INDUCTION MOTORS

8. *Motors.*

Sec. b.—Add: Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps. Where the starter when in the running position opens automatically under overload it may serve also as a circuit breaker.

Sec. b.—The insulation of the several conductors, where leaving the metal sheath of cables, must be thoroughly protected from moisture and mechanical injury by means of potheads or some similar method.

Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by No. 6 B. & S. gage copper wire and approved ground clamps.

GROUNDING

15*A*. *Method of Grounding, When Protective Grounding is Required.*

This is a new rule divided into eighteen sections, and is to be classed under Class C—Inside Work, and takes into consideration direct current systems, alternating-current systems, ground conductors, and ground connection.

26. *Wires.*

A new section is added.

Sec. a. (After July 1, 1917.)—The neutral conductor on all three-wire circuits and one conductor on all two-wire circuits must have an identifying insulating covering, readily distinguishing it from other wires. This wire must be run without transposition throughout the entire installation.

23. *Automatic Cut-Outs (Fuses and Circuit-Breakers).*

Sec. d.—The fuses in the branch cut-outs protecting circuits of 660 watts or less shall not have a rated capacity greater than that given in the following table:

125 volts or less.....10 amp.
125 to 250 volts..... 6 amp.

FUSES, SWITCHES AND METER INSTALLATIONS

23. *Automatic Cut-Outs (Fuses and Circuit-Breakers).*

Sec. a.—Where service switch, service fuses and meter are combined in a single self-contained unit device having no exposed wiring or live parts and no parts unprotected by fuses except potential coils of the meter, such potential coils may be connected on the supply side of the service fuses. Departure from the provisions of the above rule may be authorized only under special permission in writing.

THEATER AND MOVING PICTURE WIRING

A new rule, 38A, is recommended to be adopted regarding moving picture factories and studios.

SWITCH AND CUT-OUT

67. *Cut-Outs.*

The Cut-Out Section of the Associated Manufacturers of Electrical Supplies, in conference with the Underwriters' Laboratories, have prepared a revision of this rule, as given below. The matter has been reviewed by the switch and cut-out committee, who recommend that Rule 67 be amended and rearranged as indicated.

68. *Fuses.*

The switch and cut-out committee and Underwriters' Laboratories, to whom was referred the matter of revised specifications for link fuse cut-outs and link fuses, have not yet been able to carry out the necessary investigation and tests, but desire to report progress. It is expected that this work will be under way during the coming year.

68. *Fuses.*

Sec. d.—The switch and cut-out committee has continued its investigation and study of the subject of refillable fuses, and reports the following committee opinion:

"The evidence presented to or obtained by the committee does not warrant it in recommending any change in Rule 68d."

68. *Fuses.*

A revision of the specifications in this rule, including a detailed procedure for tests, was prepared and has been reviewed by the switch and cut-out committee, who recommend that Rule 68 be amended and rearranged. This revision takes into consideration Sec. d, e, f, h, i, j and k of inclosed fuses—plug and cartridge type.

Sec. j.—Short-Circuit Test.—When only one fuse is blown at a time on a system of the voltage for which the fuse is rated and under circuit conditions outlined below, the fuse must open the circuit without emitting sufficient flame or molten metal to ignite easily inflammable material entirely surrounding the cartridge and covering the vents, the cartridge to remain intact.

The normal capacity of the system must be in excess of the load on it just previous to the test by at least five times the rated capacity of the fuse under test.

The resistance of the circuit up to the cut-out terminals must be as follows:

For 125 volt fuses	0.0125 ohm.
For 250 volt fuses	0.024 ohm.
For 600 volt fuses	0.06 ohm.

CIRCUIT BREAKERS

66. *Oil Break Type (Not over 3500 Volts A. C.)*

Sec. i.—Tests.—The oil circuit breaker to be connected to a load of rated voltage, equivalent in all electrical characteristics to that of a squirrel cage induction motor of the rating of the circuit breaker with rotor blocked, current to be adjusted by means of external reactance (if necessary), limit the starting current from 6 to 8 times the normal rated current of the circuit breaker.

Under these conditions the circuit breaker must successfully close and open the circuit 30 consecutive times with one minute interval on each open position without incapacitating the circuit breaker.

CABINETS

The committee on cabinets recommends slight changes to be made to Rule 59. Outlet Junction and Flush Switch Boxes, Sec. A, and adds a new section. Rule 70 on cabinets and cut-out boxes has five new sections recommended.

The committees on transformers, electric signs and wireless telegraph apparatus recommended slight changes in the subjects they considered, and a large number of miscellaneous suggestions were brought up for consideration.

SOUTHERN CALIFORNIA EDISON TO SELL $5,000,000 STOCK

California Railroad Commission Authorizes Issues Dependent on Granting Application to Purchase Pacific Light & Power Company

The California Railroad Commission has issued an order authorizing the Southern California Edison Company to sell $5,000,000 of common capital stock at not less than 91.5, the proceeds to be expended from time to time under the commission's order, as follows: Not exceeding $4,000,000 to pay for $5,000,000 face value of bonds, issued by the Pacific Light and Power Corporation. This issue is dependent on the granting of the Edison company's application to buy the properties of the Pacific corporation, which application is now pending before the commission; not exceeding $2,480,405 to discharge notes of the Pacific Light and Power Corporation, this also being dependent on the merger; to pay part of proposed additions and betterments during 1917 and 1918, the amount contemplated being $7,992,000.

In July, 1913, the Edison company was authorized to issue $3,000,000 of common capital stock at 80 per cent of par, to retire indebtedness and make additions and betterments. The order provided that if $2,000,000 of the stock were underwritten at 80 per cent., $2.50 a share commission might be paid, and later the selling price of the stock was raised to 82.5 per cent, and the commission to $5 a share. In March, 1915, the Edison company was authorized to issue $2,750,000 stock to refund an issue of five year 6 per cent debentures.

At the present time the company has out $4,000,000 of first preferred stock, $12,500,000 of second preferred stock and $10,411,00 of common stock.

PUBLIC INTEREST AND LOW STOCK PRICES INCONSISTENT

Massachusetts Commission Increases Prices of Tenney Companies' Securities Over Those Petitioned, Scaling Down Value of Rights

In three decisions dated Feb. 16 the Massachusetts Gas and Electric Light Commission approved the issue of additional capital stock by the Fitchburg Gas & Electric Light Company, the Haverhill Electric Company and the Springfield Gas Light Company to the extent of 6543 shares. The board ruled, however, that the prices fixed by the respective boards of directors in the petitions for security increase were in each case materially lower than will insure a ready market for the stock, and so low as to be inconsistent with the public interest. On this account the commission fixed the prices of the shares above those named by the petitioners at points representing a total difference of $173,855 between the board and the companies. In scaling down the value of rights the board pointed out that in the case of each company recent sales show that the outstanding capital stock commanded prices considerably in excess of the prices fixed by the directors. The following table summarizes the action of the commission:

	Price Fixed by					Difference in Prices Petitioned and Fixed	
	Directors	Commission	Recent Sales	Par	No. Shares Authorized	Per Share	Total
Fitchburg	$85	$100	$115	$50	2,400	$15	$36,000
Haverhill	130	275	210	100	1,714	45	77,130
Springfield	200	225	260	100	2,429	25	60,725
Total					6,543		$173,855

The proceeds of these new securities are to be devoted to paying floating debts incurred in extensions, improvements, etc. In the case of the Fitchburg company, dividends have been paid regularly for seven years at the rate of 10 per cent. The Haverhill company has paid 10 per cent regularly for four years and the Springfield company has paid regular dividends at the rate of 12 per cent for nine years.

MEETING OF SALESMEN'S HANDBOOK COMMITTEE CALLED

Advisability of Separating Sections so That Members with Particular Interests Will Receive These Sections Only to Be Discussed

A meeting of the Salesmen's Handbook Committee of the Commercial Section, N. E. L. A., will be held on Feb. 27, at headquarters in New York City, for the purpose of discussing the committee's report and for further discussion on methods of taking care of the increased size of the handbook and on increasing the use of the handbook. There will also be discussed the advisability of separating the different sections of the handbook so that members interested in particular sections will obtain those sections only.

The electric vehicle section will be completely revised by a sub-committee of the Electric Vehicle Section of the association. The following is an outline of the data to be included in the revision: *General*—comparison with other forms of vehicles; *revenue for central stations*—value of load; *passenger*—description, uses and advantages; *commercial load*—description, uses and advantages, cost of operation; *industrial*—description, uses and advantages, cost of operation; *miscella-*

neous equipment—batteries, tires, charging apparatus and operation.

Efforts are being made to secure for manufacturers data on types of reflectors and their application for the lighting section, and a report will be submitted at this meeting.

The final draft of the section on "Air Handling" in the poorer section has been made up, and is now practically ready for the printers. This section is intended to include data on all forms of air handling, showing the application of the different forms of apparatus for furnishing air. This ought to be ready for circulation inside of the next few weeks. The article on "Refrigeration" is being revised by C. J. Carlsen, and should be ready for the printers by March 1. The general data on "Power" and on "Isolated Plants" is in the hands of the power sales bureau, and will be presented to the committee for publication. Very little has been done on the preparation of short articles, descriptive of each class of industry, and the committee feels that it should take some active steps to get this work completed as soon as possible.

For the electric heating section data are to be included on "Electric Ranges," "Industrial Heating," and typical installations. Manufacturers are to furnish data on their equipments applicable to all domestic and industrial heating. R. H. Tillman is chairman of this committee.

EXTRA SESSION OF CONGRESS NOW DEEMED IMPROBABLE

Democrats and Republicans Refuse to Bargain with Independents for Committee Chairmanships, a Number of Which Are of Importance to Electrical Industry

Unless some unforeseen event in connection with the international situation should arise which might make it advisable, it seems improbable, according to the latest information obtainable in Washington, that there will be an extra session of Congress in the near future. This is indicated in reports at Washington that President Wilson does not even intend to conform to custom and call the Senate in extraordinary session for the purpose of confirming appointees. The President is credited with believing that his cabinet officers have already been confirmed—most of them four years ago, when he first took office—and that there is no necessity for him to again lay their names before the Senate for confirmation.

Some well-informed Washingtonians believe that President Wilson does not need any power from Congress to deal with international events which may arise. They instance the fact that he dispatched the Atlantic fleet to Mexico without first consulting Congress, and that under the Constitution President Jefferson dispatched an American squadron to Tripolitan waters to protect American commerce without consulting Congress. In some quarters it is believed that the presence of Congress in Washington in the near future might be a handicap to President Wilson rather than an aid.

In this situation there is no probability that the Republicans will organize the House of Representatives as a Republican body in the near future. As the situation stands, there are 214 Republican members and 214 Democratic members of the next House, with five independents apparently holding the balance of power. The latest reports are that overtures from these five independents to one side or the other for important committee chairmanships in return for support have met with repulses from both Democratic and Republican members of the House, who say they will not be led into bargaining for some of the most important committee chairmanships, among which a number are of importance to the electrical industry, such as Judge Adamson's seat, which has control of water powers in navigable streams; Judge Flood's seat on the committee on foreign relations, which has control of Niagara water-power matters; the patent committee chairmanship, etc.

OUR DELAY IN DEVELOPING THE NITRATE INDUSTRY

California Commission Compares Highly Developed Field Abroad with Failure to Utilize Hydroelectric Power in This Country

The attention now being directed toward the use of hydroelectric power in the manufacture of nitrates has led the State Water Problems Conference appointed by the Governor of California to devote considerable space to this subject in its recent report, an extract of which appeared in the ELECTRICAL WORLD for Feb. 3, 1917. In order to emphasize the latent possibilities in this field in the United States, comparisons are drawn with the nitrate industry in foreign countries. The following has been taken from the report:

Europe uses per acre of cultivated land 200 lb. of fertilizer; the United States uses 28 lb. Germany, in twenty years, by the use of fertilizer, has increased the average yield of all crops grown three and one-half times as much per acre as America. The German Agricultural Department reports show that by feeding the soil with 2,000,000 tons of nitrate there was secured an increase in crops of 63,000,000 tons. In Germany intelligent effort has been directed to replace the nitrogenous compounds extracted from the soil by crop growth; in the United States the average agriculturist has seen his land yield steadily decreasing crops without attempting adequate remedy.

The average yield per acre in bushels for various crops in the United States and in Europe is as follows:

	Wheat	Oats	Barley	Rye	Potatoes
Europe	32	47	38	30	158
United States	15	29	25	16	96

"As a measure of preparedness in event of war the United States has been attempting to accumulate a reserve stock of 32,500 tons of Chilean nitrate. Her army and navy use annually in peace 3000 tons. The reserve stock contemplated would make enough explosives to last possibly a week in a modern war, and at the end of that time the nation would be powerless unless her navy were strong enough to enable her to commandeer a supply from Chile, against the efforts of her enemy and possibly the wishes of the world. A cheerful outlook for a nation whose foreign relations are becoming complicated!"

A country with great natural water-power resources can by the proper use thereof make itself independent of the foreign supply of nitrates. Nitrates can be readily extracted from the air by hydroelectric power, and where there is a general distribution of the necessary rock deposits used in these processes, which is the case throughout the West, it may be considered that 1.5 hp. of hydroelectric energy will produce a ton of sodium nitrate per year. The method of manufacturing fertilizer from Chilean deposits produces a composition of 12 per cent active fertilizer and 88 per cent useless material on which freight must be paid, while the electro fertilizer product contains 60 per cent of fertilizing material.

The United States is importing from Chile annually 625,000 tons of nitrate, valued before the war at $23,000,000 (including the Chilean export duty of nearly

$8,000,000), but now worth $37,500,000. That entire amount of nitrate could be manufactured in California by utilizing 1,000,000 hp. of its unused water-power resources. California itself is using about 50,000 tons of Chilean nitrate annually at a cost before the war of nearly $2,000,000, increased now to $3,000,000. Many times this amount should now be used annually in that State, and this will doubtless come in time. A 75,000-hp. hydroelectric plant would supply the nitrates now used in California.

ANNUAL MEETING A. M. E. S. SCHEDULED FOR MARCH 15

February Meetings of All Sections of the Association Are Postponed to the Week Commencing March 12

The annual meeting of the Associated Manufacturers of Electrical Supplies will be held on March 15, at Delmonico's, New York City. The association has made remarkable progress during the past year, and it is anticipated that the annual meeting will be largely attended, and will be an interesting and enthusiastic one. The meeting will be followed by a banquet in the evening.

The board of governors of the association held its regular meeting on Feb. 21 at the offices of the association.

The regular meetings of all sections of the association scheduled to take place in February have been postponed to the week commencing March 12. This change was made to meet the convenience of out-of-town members desiring to attend the annual meeting and banquet.

The following schedule of meetings has been arranged:

March 13.

Fan motor section, offices of the association, 10.30 a. m.
Knife switch section, offices of the association, 10.00 a. m.
Panelboard and switchboard, offices of the association, 2.00 p. m.
Snap switch section, offices of the association, 2.00 p. m.
Lighting fixture section, Hotel Biltmore, 10.00 a. m.
Outlet box section, Hotel Biltmore, 2.00 p. m.
Lamp receptacle and socket, offices of the association, 9.30 a. m.
Fuse section, offices of the association, 2.00 p. m.
Attachment plug section, offices of the association, 4.00 p. m.
Committee on inclosed fuses, offices of the association, 9.30 a. m.
Moulded or formed insulation section, Hotel Biltmore, 10.00 a. m.
Line material section, Hotel Biltmore, 2.00 p. m.
Porcelain section, Hotel Biltmore, 10.00 a. m.

NOMINATIONS FOR FEDERAL TRADE BOARD VACANCIES

President Wilson Sends Names of Former Governor Fort of New Jersey and William B. Colver of St. Paul to Senate for Confirmation

President Wilson has sent to the Senate the nominations of former Governor Franklin Fort of New Jersey and William B. Colver of St. Paul, Minn., for the vacancies on the Federal Trade Commission created by the retirement of Edward N. Hurley and the fact that the Senate refused to confirm Commissioner Rublee, who has served for some time as a recess appointee, but who will not be nominated again. Mr. Rublee was recently appointed a member of the commission to observe the working of the so-called eight-hour railroad labor law.

Mr. Fort is a Republican, and resides at South Orange, N. J. He was born in that State in 1852, and is a graduate of Albany Law School, Rutgers College and New York University. From 1878 until the time he became Governor of New Jersey in 1908, in which position he served until 1911, Mr. Fort served on the judicial bench of New Jersey in various positions, ending with service on the Supreme Bench of that State.

Mr. Colver is a newspaper man, and in a statement made public in connection with his appointment he is described as "a man of very unusual familiarity with economic, social and political questions." He is a Democrat, forty-six years of age. For many years he was associated either as editor or publisher with the Scripps-McRae League of newspapers, the Newspaper Enterprise Association, etc. In recent years he has been a resident of St. Paul, Minn., actively engaged in the management of the publications known as the Clover Leaf Association.

The positions pay $7,500 a year. Mr. Colver is appointed to fill out Mr. Hurley's unexpired term and Mr. Fort is appointed for a term of six years.

It is not known whether the appointments will be confirmed by the Senate without opposition. The single objection of Senator Gallinger of New Hampshire to Mr. Rublee served to keep the latter from being confirmed. Mr. Gallinger's only objection to Mr. Rublee was that Mr. Rublee was "personally obnoxious" to Senator Gallinger. Under the rule of Senatorial courtesy this served to prevent Mr. Rublee's confirmation.

NEW ENGLAND ELECTRICAL MEN VISIT PROVIDENCE

Inspection Made of Property of Narragansett Electric Lighting Company Followed by "Get Together" Luncheon

Over 100 central station and affiliated electrical men convened at Providence, R. I., Feb. 15, upon the initiative of M. R. Griffith of the General Electric Company, Boston, Mass., and under the general auspices of the New England Section of the N. E. L. A., to inspect the property of the Narragansett Electric Lighting Company and hold a "get-together" meeting at the Crown Hotel. A special car attached to the 10.05 a. m. train out of Boston carried about sixty, and upon arrival in Providence the offices and electric shop of the Providence company in the Turk's Head Building were visited. This was followed by a luncheon, at which E. R. Davenport, sales manager of the Narragansett company, presided. Among the speakers were R. S. Hale, chairman of the N. E. L. A. committee on wiring; C. E. Greenwood, Boston Edison company; A. H. Allcott, in charge of the Narragansett company's electric shop; F. A. Gallagher, head of the company's lighting department; Franklin Hall, auditor, and J. A. Gibson, in charge of electric sign campaigning. The film "The King of the Rails" was shown at the close of the speaking.

Mr. Hale outlined the methods of the wiring committee in working toward unification of plug and receptacle designs through conferences among manufacturers. It is hoped to secure one standard plug for the "socket end" of flat-iron and other appliance cords, and it would be a notable gain if a similar standardization could be attained on the appliance end of the cord. Nothing is forced upon the manufacturing interests, but through conferences the reduction of diversified types of plugs has been materially promoted. Mr. Davenport suggested that central stations specifying that an appliance must be equipped with a standard attachment plug would help this development.

The success of the Narragansett company's electric

shop, located on the ground floor front of one of the finest office buildings in the city, was the principal topic of discussion at the meeting. Operated purely on merchandising principles, with the idea that every transaction should carry its legitimate cost to the consumer, this shop cleared $6,500 in 1916, after all rental, advertising and operating costs were covered. Mr. Allcott presented a paper dealing with the electric shop policies in condensed form, emphasizing the importance of purchasing goods advantageously and effecting substantial savings by anticipating requirements, placing orders with factories for goods for future delivery which could be made up during the dull season. Under the sale of portable lamps, Mr. Allcott pointed out that 1400 were sold last year, frequently two or more per customer. Inquiry developed their use for decorative purposes, and an attractive field for expansion appears open here.

Promptness in repairing appliances has been secured by a repair shop located in the basement of the store, and every effort is made to render twenty-four-hour service, except where appliances have to be renickeled. Last year the company received over $1,000 from customers as charges for repairs, and no difficulty whatever was experienced in collecting these charges when the repairs were made necessary by the ordinary wear and tear and not covered by a guarantee, or due to a defect. The electric shop in Providence did a gross business in 1916 of $150,000, of which $74,000 was in electric appliances and the remainder in tungsten lamps. January, 1917, showed a gain of 168 per cent over January, 1916.

Mr. Gibson discussed the spread of electric sign business on the basis of a campaign in which the company assumed the selling expense, thereby gaining lower prices from the manufacturers. In eleven weeks twenty-eight signs of 48 kw. connected load were added.

WEBB EXPORT TRADE BILL REPORTED FAVORABLY

Believed That Amendments Suggested by Senate Committee Will Be Agreed to by House Conferees so That Bill May Become Law at Present Session

Senator Pomerene has reported to the Senate from the Committee on Interstate Commerce the so-called Webb bill which would permit combinations of exporters engaged in foreign trade. It is recommended that the bill be passed. The measure, known as H. R. 17,350, has already passed the House, and it is believed in Washington that certain amendments suggested by the Senate Committee would be agreed to by House conferees, and that the bill may become a law at this session.

The report on the bill points out that the Federal Trade Commission has found that European nations with great liberality permit organizations or combinations in respect to their foreign trade, and states that since the beginning of the European war the Allies have organized buying agencies for the benefit of their governments and their peoples.

"Our merchants and manufacturers," the report states, "must meet this situation. Very few of them can compete single-handed with these great combinations. Our belief is that it is necessary to permit our business men to form similar organizations or associations, so as to enable them to meet foreign competitors on a more equal footing. In this way they will be able to reduce selling costs."

The important Senate committee amendments have, it is stated in the report, the following objects:

"The authority thereby conferred should not result in the restraint of trade within the United States, which is clearly prohibited by the Sherman Law.

"While the purpose of the bill is to increase our foreign trade it should not result in destroying the business of other companies, associations or individuals who may be engaged in the foreign trade.

"The purpose is to increase and improve this trade —not to injure it.

"While we realize that any sales in foreign commerce may incidentally and temporarily result in the increase in prices of the same article to home consumers these associations should not be permitted to so conduct their affairs as to artificially or intentionally and unduly enhance prices of the commodities in which they are dealing to a home consumer."

One of the Senate Committee amendments places the power and responsibility for enforcing and supervising the act upon the Federal Trade Commission.

EMERGENCY FLOOD-LIGHTING OF NEW YORK BRIDGES

How City Engineers and Lighting Companies Are Co-operating to Flood-Light the Bridges Over the East River

New York City central station companies are now co-operating with the municipal engineers to flood-light all the bridges over the East River. Projectors have been placed under the arches of the bridges, along the water-front and around the stone piers as a precautionary measure and to assist the militiamen in watching over the vital sections. The fall of the Brooklyn or Manhattan Bridges would cut off the navy yard from the main ship channel, while the fall of the Williamsburg, Queensboro and the inter-connecting railway bridges would block the internal lines of traffic. Ninety guardsmen are stationed on each bridge and machine guns and three-pounders are located under the bridges.

On Saturday, Feb. 3 at 4 p. m. an order was issued to increase the illumination of all bridges, including anchorage points of suspension bridges, bases of piers, and the underside of bridge flooring by the use of flood-lamps, arc lamps and search-lamps. On Sunday night the three lower bridges on the East river were illuminated; on Monday the Queensboro bridge, and on Tuesday the inter-communicating bridge was illuminated. As there were but few lamps available for this purpose a man was sent to Lynn, Mass., for a carload of suitable types. About 300 employees of the city and of the lighting companies were required to install these lamps at the time set. All work is of a temporary nature and lamps are fed from the nearest source of supply in each instance. Some lines were tapped from cables on bridges, some from street lighting circuits and from other sources. The New York Edison Company, the Edison Electric Illuminating Company of Brooklyn and the New York & Queens Electric Light & Power Company furnish the energy for this purpose.

About 100 flood-lamps rated for 500 and 750 watts, more than 200 Type C lamps and a large number of 100-watt Mazda lamps are used. Several large search-lamps are also kept in action continually, while small naval boats with search-lamps cover the piers and bases of the bridges. Danger signs to keep boats away from the bridges have been posted and are illuminated. In addition as a matter of safety a 50-ft. deadline has been ordered around the pier of each bridge.

This work has been carried out under the direction of David F. Atkins, chief engineer of the department of water supply, gas and electricity, and Samuel G. Rhodes of the New York Edison Company.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public-utility companies.

Where Burden of Proof Showing No Negligence Rests with Light Company.—In an action for death due to unsafe condition of an electric transformer used to step down from 2300 volts to 110 volts, where a young man was killed in attempting to turn out an electric lamp by means of a wall switch, it was held by the Supreme Court of Pennsylvania, in Seeherman vs. Wilkes-Barre Company (99 A. 174), that the result speaks for itself, and that the law imposed on the defendant the burden of showing that it was not negligent.

Extent of Right of Power Company.—An act forbidding the exercise of the power of eminent domain by any water company thereafter incorporated as to the appropriations of streams, rivers, or the land covered thereby, does not forbid a water company from taking land outside the limits of a stream for the purposes of a reservoir, it was held by the Supreme Court of Pennsylvania (98 A. 1032) in Brumbaugh vs. Raystown Water Power Company.

Statute Regarding Height of Wires.—A statute providing that all wires strung upon poles should not be less than 24 ft. above the ground at all crossings and not less than 14 ft. above the ground at other places did not apply to a light and power company in the construction of its line over a bridge having a wire only 22 ft. 2 in. above the floor of the bridge attached to poles on each side at a height of more than 24 ft. where the wire at the place of discharge was 32 ft. above the ground, it was held by the Supreme Court of Wisconsin in Vannatta vs. Lancaster Light & Power Company (159 N. W. 940).

Liability for Damages Caused by Excavation.—A company excavating in a street to repair its own conduits, though authorized to do so by the city, is liable to the owner of a stock of goods damaged by water seepage due to the excavation, regardless of its negligence it was held by the Appellate Division of the Supreme Court of New York, in May vs. New York Edison Company (161 N. Y. S. 886).

Salesman Inspecting Installation of Machinery Regarded as Employed in Manufacture Thereof Under Compensation Law.—A salesman of a manufacturer of machinery whose duties require him to inspect the apparatus generally, and who does inspect it after it is set up and in operation, during which inspection he is injured by the fall of a piece of it, may be regarded, according to the Court of Appeals of New York, in Benton vs. Fraser (114 N. E. 43), as employed in the manufacture of machinery under the workmen's compensation law.

Company Has No Right to Discontinue Service Upon Tender of Payment.—Notwithstanding the contract of an electric company provided for discontinuance of service, without notice, upon non-payment of consumer's bill within ten days from its date, the Supreme Court of Arkansas held, in Little Rock Railway & Electric Company vs. Leader Company (188 S. W. 1182) that the company had no right to discontinue service after the tender of the proper amount by the consumer, although he was in arrears, for the consumer should have notice and reasonable opportunity to pay before enforcing forfeiture of the contract, forfeitures not being favored.

Contract vs. Approved Sketch.—That the terms of a contract do not necessarily hold when not in accordance with an approved sketch or drawing was in substance the decision of the Supreme Court of New York in American Sign Company vs. Rundback (161 N. Y. S. 228). A written contract was made for an electric sign specifying 359 lamp sockets. The approved sketch, however, called for 319 lamp sockets and showed where each socket was to be placed, the sketch going so far as to enumerate the number of sockets for each part of the sign. The defendant refused to accept and pay for the sign, claiming that the terms of the contract had not been fulfilled, but the court held that where the design not only showed the number and position of the lamp sockets if counted, but plainly shows in a conspicuous position the number provided, it must be held that the defendant agreed to pay for the sign shaped in that design and containing the number of lamp sockets pictured on the design and also stated thereon.

Public Utility Monopoly.—A party, complaining of an order of the State Public Utilities Commission, permitting one telephone company to purchase a controlling interest in another and insolvent company, who shows no special damage resulting to him from the purchase by the first company of the stock and bonds of the other company from persons other than himself, cannot raise the question whether the purchase violates the federal anti-trust law, enforcement of which is committed to the attorney-general of the United States, except where an individual can show some special damage to himself from a violation of the act, it was held by the Supreme Court of Illinois (114 N. E. 190). Where a commission authorized a foreign telephone company to purchase a controlling interest in an insolvent domestic company, the order of the commission expressly preserving the integrity of the domestic company and its franchise rights there was no violation of the State public utilities act providing that no franchise, license, permit or right to own, operate, manage, or control any public utility, except common carriers in interstate commerce shall be granted or transferred to any grantee or transferee other than a corporation duly incorporated under the laws of the State, as the term "public utility" means the plant operated by a public utility, and not the corporation.

Commission Rulings

Important Decisions of Various State Bodies Involving or Affecting Electric Light and Power Utility Operation and Practice.

New Rates Superceed Old Ones.—In a complaint to the Pennsylvania Public Service Commission alleging an overcharge by the Duquesne Light Company of $110.67 for energy furnished between July 1, 1914, and April 1, 1916, it was brought out that the contract for supply was entered into in March, 1913, at a minimum charge of $30 per month. On July 1, 1914, however, the company filed with the commission a schedule under which the minimum rate for this class of service was $26.

The commission held that the complainant was entitled to reparation to the amount by which his payments under the $30 minimum had exceeded the amount he would have been required to pay under the $26 minimum, and an order awarding reparation in the amount of $72 was entered.

Reproduction Costs Modified to Basis Under Normal or Average Conditions.—In a hearing before the Public Utilities Commission of Colorado concerning the rates of the Mountain States Telephone & Telegraph Company, the commission stated that "in arriving at the value of the property by the method of the cost of reproducing the property as the term is understood, the term is not used in its strict sense, but is so modified and altered as to bring before the commission the cost of reproducing the property under normal or average conditions, due regard being given to the conditions under which the property has been actually constructed and the prices paid for labor and materials.

"It can be readily seen that in reproducing a property to assume the prices of to-day would bring about an improper result, as would the prices during a period of financial depression."

Confidence of Public Secured Only by Full and Frank Publicity.—In its annual report for the year ended June 30 last, the Idaho Public Utilities Commission made the following statement: "We believe that the people of Idaho are willing to pay rates that will insure to the utilities serving them a reasonable return on the value of the property used and useful in the public service, but they object to paying returns on promoters' profits or watered stock. Utilities can secure and retain the confidence of the public only by doing business in the open, giving full and frank publicity to all their operations affecting service to the public. We believe that the public utilities of our State realize that full publicity is the wisest and best policy for them to pursue, and are pleased to state that none of them has shown a disposition to hide from the Commission any of its operations."

Missouri Commission Report.—The fourth annual report of the Public Service Commission of Missouri for the eleven months ended Nov. 30, 1916, has recently been published.

Electric Pumping Costs Less Than by Steam.—A recent report by the superintendent of the city water works of Faribault, Minn., shows that the cost of pumping water by electricity during the past nine months has been $2.55 per million gallons less than the average cost of pumping by steam, which method was used during the previous four years. The electric pumping load is served by the Northern States Power Company, which company was instrumental in inducing the city officials to test the efficacy and economy of pumping by electricity.

May Sell Municipal Plant.—Mayor George Puchta of Cincinnati, Ohio, said recently that he would call a meeting of the Board of Control to discuss the advisability of selling the municipal light plant at Madisonville, now a part of the city. The plant has been unprofitable, although the rate has been 9.5 cents per kilowatt-hour. Under the circumstances, the plant could not operate at 8.5 cents, the new rate to be charged by the Union Gas & Electric Company, but the Mayor has promised customers that the company will extend the new rate to them after the municipal plant is sold.

Regulations for Electric Concessions in Panama.—The Government of Panama has decreed that only the executive may grant concessions for the use of land and water for the production and distribution of electric light and power. The law as published in the *Gaceta Oficial* stipulates that concessionaries, in return for specified exemptions, must agree to grant the Government a part of their gross proceeds from electric service, and to furnish electricity for public purposes at a reduction of not less than 25 per cent from the rates charged private consumers. Companies installing electric light in a city of at least 45,000 inhabitants must transmit their current underground. Contracts executed by the executive in conformity with this law will not require legislative approval.

Rules and Regulations of Pacific Gas & Electric to Be Revised.—After an all-day session before officials of the Railroad Commission of California, it was unofficially stated that "all of the rules and regulations of the Pacific Gas & Electric Company regarding its relations with consumers are to be revised, rewritten, and generally made less liable to arbitrary action by employees of the company." During the hearing Max Thelen, president of the commission, stated that he thought more satisfactory rules could be drawn. He thought that the existing rules were "of drastic and mandatory character" and left too much to the discretion of company employees. It is understood that the revision is to be done by experts of the railroad commission working in conjunction with the gas company's experts.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Recommends that Municipal Plant Be Built in Coal Fields.—It is said that Light and Heat Commissioner W. E. Davis of Cleveland, Ohio, will recommend in a report to be presented to Council shortly that a large station be built by the city on coal lands to be leased or purchased outright. He estimates that energy may be transmitted from this plant to Cleveland and sold at 3 cents per kilowatt-hour for lighting and 1 cent for heating. He will not recommend hauling coal to operate such a plant located in the city.

A Companion to the Famous Mills Bill in Ohio.—Senator H. H. Timby has introduced a bill in the Ohio Legislature which provides that municipalities may issue general credit bonds to purchase, acquire by condemnation, or construct municipal telephone plants. The Mills bill, introduced at two different sessions in the past, and defeated both times, gave the right to municipalities to issue general credit bonds for the acquirement of all kinds of public utilities. The last measure is very radical, and contains a complete code governing the operation of municipal telephone plants. It limits the length of the lines outside the city to 10 miles. Plants are to be free of all taxes, but taxes may be levied in a general way to pay the interest on and provide a sinking fund for bonds during construction. It thus places the interest charge on users and non-users of the service alike for this period, and provides a further authority for issuing bonds, aside from the limitations prescribed by the Longworth act.

Wisconsin Power Properties Purchased.—L. E. Myers, of the L. Myers Company, contractors, Chicago, has purchased the Ironwood (Mich.) & Bessemer Railway & Light Company, including the Gogebic & Iron Counties Railway & Light Company, the Ashland (Wis.) Light, Power & Street Railway, the Ashland Power Company; Hurley (Wis.) Water Company and Ironwood Water Works Company, the Big Falls, Tylersfork, Brownstone Falls, Copper Falls and Superior Falls power developments on the Montreal, Flambeau and Tylersfork Rivers are also included in the transfer. Upon the completion of the work that is now under way these properties will comprise about 40,000 hp. in water power and steam auxiliaries. About 9000 hp. in steam plants is under construction. The consideration involved in the sale was about $3,500,000. L. E. Myers has been elected president of the several companies and L. N. Bosen, of the Myers company, was elected vice-president. The present local managements will be continued.

Electrical Output of American Gas Company Increased 27 Per Cent.—The annual report for 1916 of the American Gas Company, which operates both gas and electric properties, stated that the electrical business generally had grown rapidly during the year, there being an increase in the kilowatt-hours sold of about 27 per cent. The cubic feet of gas sold during the year increased only about 14 per cent. The report showed gross earnings of $4,491,817.73, which is an increase of $512,203.32 for 1916.

Bill to Impose Additional Tax of $1 per Horsepower on Generating Companies.—A bill has been introduced into the New York State Legislature, amending sections 192 and 197, and adding new section 189-a, tax law, by imposing on every corporation, joint stock company, or association, generating electricity by water power within the State, or transmitting to the State electricity so generated elsewhere, an additional annual franchise tax of $1 per unit of horsepower based on the average daily amount of electricity so generated or transmitted, and requiring such corporation to report to the tax commission annually on or before Nov. 15.

The Provincial Electric Supply Committee of Great Britain.—This committee has been formed with the principal object of providing a central and representative body to afford a ready means of co-operation in protecting and furthering the financial, commercial and legislative interests of English provincial electric light or power companies, working under provisional orders. The committee proposes to direct particular attention to the following matters: (1) To organize and arrange for united action, in protecting common interests as and when occasion arises and such united action is necessary and desirable. (2) To afford the readiest means for considering such questions as rating, income tax, assessments, excess profits tax, emergency and other legislation, rates for supply, fiscal and other matters generally affecting the companies' interests. (3) To prepare, collect and distribute among the members statistics or other information of common interest, and to print and issue other literary matters for the use of members desiring to avail themselves of the facilities offered. (4) To afford facilities for intercourse between the directors of the companies represented on the committee with a view to the consideration of any questions affecting the common interests. (5) To watch over the interests of the companies and take any steps expedient with a view to correcting misstatements that may appear in the public press. (6) To assist in the compilation of official statistics and information on a uniform basis where such is desirable, and to the benefit of the companies. (7) To appoint sub-committees to deal with any special matters arising, and generally to initiate, organize, and carry out any work having for its object the protection or furtherance of the interests of the companies.

Causes of Prosperity and Depression.—At the 182nd meeting of the Schenectady section of the A. I. E. E. held Feb. 2, George E. MacIllwain delivered an address on the topic, "The Real Causes of Prosperity and Depression."

Worcester Polytechnic Institute Branch, A. I. E. E.—The fifth regular meeting of the branch was held on Feb. 23. W. H. Blood, Jr., of Stone & Webster, spoke on "Grounding of Alternating-Current Secondary Distribution Systems."

Automobile Head Lighting Practice.—The February meeting of the New England Section of the Illuminating Engineering Society was held on the sixteenth at Boston. S. Carleton Rogers spoke on "Present Practice in Autumobile Headlighting."

Automatic Telegraphy.—C. E. Davies, traffic superintendent of the Great Northwestern Telegraph Company, spoke before the Toronto section of the American Institute of Electrical Engineers on Feb. 16, on the subject, "Automatic Telegraphy." In addition the members of the Institute took a trip to the telegraph exchange.

The Electric Development and Jovian League of San Francisco.—At the Feb. 7 meeting of this organization, H. F. Jackson, president of the Sierra & San Francisco Power Company, outlined the plans and purposes of the new Pacific Coast Section of the National Electric Light Association, which was recently formed, and which will hold its first meeting in southern California within a few weeks.

New Jovian League.—The Stark County, Ohio, Jovian League was organized at a recent meeting held at Massillon, Ohio, by members of the electrical industry from several cities, and a prospective membership of 100 is anticipated. The officers elected at the meeting are O. A. Acuff, Massillon, president; H. F. Heyman, Alliance, vice-president; Robert E. Lane, Canton, secretary; Messrs. Steele, Vincent, Cope and Horner, executive committee.

Louisiana Engineering Society.—At the annual meeting of the society, Jan. 13, the following officers were elected to serve for the ensuing year: President, A. T. Dusenbury; vice-president, John Klorer; secretary, W. T. Hogg; treasurer, Ole K. Olsen; director, John Riess. The other members of the board holding over are Rufus S. Manley and Samuel Young. L. P. Breckenridge, professor mechanical engineering, Yale University, spoke on "The Engineer, His Opportunity and His Obligation."

Illinois State Electric Association.—At the reorganization of the Illinois State Electric Association the by-laws were amended to include associate members. The associate members will consist of salesmen and representatives of electrical manufacturers. The associate members of this association will have all the advantages of the meetings of the association that the regular members have, with the exception that they have no voting power and are not present at the executive sessions, if any, and do not hold office.

Associations and Societies

A complete Directory of Electrical Associations is regularly printed in the first issue of each month on the next-to-last text page.

New York Electrical Credit Association.—The adjourned 1916 annual meeting will be held at headquarters, 120 Broadway, during the afternoon of Feb. 28.

Lighting Practice.—At the second bimonthly meeting of the Texas branch of the American Institute of Electrical Engineers on Jan. 26, L. M. Krausse read a paper on "Illumination." This was followed by an illustrated lecture by Prof. J. M. Bryant of the Electrical Engineering School of the University of Texas, on "Street Lighting."

Portland (Ore.) Section A. I. E. E. and N. E. L. A.—At the regular monthly meeting of the sections on Feb. 6, at the Multnomah Hotel, William Conger Morgan, professor of chemistry at Reed College, spoke on the subject, "The Newest Chemical Element — Electricity." Stereopticon slides illustrated the address. The meeting was under the auspices of the N. E. L. A., J. C. Henkle, chairman.

Meeting of Iron and Steel Electrical Engineers. — The regular monthly meeting of the Association of Iron and Steel Electrical Engineers was held on Feb. 17, at the Fort Pitt Hotel, Pittsburgh, Pa. Papers on "General Safety Movement and Accident Prevention" were presented by the safety committee, of which H. A. Schultz is chairman. The March meeting of the Pittsburgh section will be held on March 17 at the Fort Pitt Hotel, under the auspices of the electrical development committee, of which Stewart Coey is chairman. The Philadelphia section will hold its March meeting on March 3, at which time the speaker will be C. T. Henderson of the Cutler-Hammer Manufacturing Company. The eleventh annual convention of the association will be held in Philadelphia.

Series of Evening Meetings for Louisville Jovians.—An interesting series of evening meetings is projected by the Louisville Jovian League. An evening meeting will be held each month. On Feb. 26 a supper meeting, with the ladies present, will adjourn to a moving picture theater, to see electric pictures and safety-first pictures; in March there is to be a dinner dance meeting; in April a lecture meeting, for which an out-of-town speaker will be provided; May is to see production of an amateur theatrical by the members of the league, and June will bring the annual river excursion. These evening meetings are proposed in order that the members of the organization who cannot get out to the noonday meetings will have some interest in their membership. One noon meeting will be held each month.

American Institute of Consulting Engineers, Inc. — At the council meeting on Feb. 6, the following officers were elected for the year 1917: President, George Gibbs; vice-president, Lewis B. Stillwell; secretary and treasurer, F. A. Molitor.

Address on Criminality at Buffalo.—The February meeting of the Buffalo section N. E. L. A. was held on Feb. 13, in the amphitheater of the Electric Building. After a moving picture entertainment, Henry J. Girvin, chief of detectives of Buffalo Police Department, addressed the meeting on the subject of "Criminality." Following this address, the meeting was given over for a short time to an amusing Valentine party, in which many appropriate souvenirs were distributed and considerable interest manifested, after which the meeting adjourned to the floor below for refreshments.

Plans for Civic Activities Outlined to St. Louis Jovians.—At what proved to be its largest and most enthusiastic meeting of the year, the St. Louis Jovian League listened to an outline of plans for civic activities, on Feb. 13. The speaker was J. Lionberger Davis, the newly-elected president of the St. Louis Chamber of Commerce. Mr. Davis laid particular stress on the great value of co-operation between civic and commercial bodies, in the work of developing and improving the city. He made a splendid plea for the support of the Jovian League for several movements being inaugurated by the Chamber of Commerce.

Fire Hazard of Electricity.—At the regular monthly meeting of the New York companies section of the N. E. L. A., held on Tuesday evening, Joseph C. Forsythe of the New York Board of Fire Underwriters spoke on "Electrical Fire Hazards." Last year 124 fires in New York City were found to have been caused by electricity with a fire loss of $91,549. In 1915, 30,000 fires from electrical causes were reported in the United States or about 5 per cent of the total number of fires. Mr. Forsythe pointed out the rapidly growing fire hazard of the electric flatiron. Following Mr. Forsythe, Mr. Roberts, a newspaper correspondent, spoke on some of his personal experiences with Francisco Villa, the Mexican revolutionist.

Meeting of Philadelphia Illuminating Engineers.—The regular monthly meeting, Philadelphia section, Illuminating Engineering Society, was held at the Engineers' Club on Feb. 16. The speaker of the evening was L. C. Porter of Harrison, N. J., who presented a paper on the subject of "Flood-Lighting," amply illustrated by lantern slides. Preceding the reading of the paper, F. H. Gilpin combined the twenty-minute talk on the "Fundamentals of Illumination" with the discussion of "Illumination" and "Brightness." Botn parts of the meeting were fully discussed. Following the meeting, the members and their friends visited the City Hall to inspect the flood-lighting equipment of the tower.

E. G. ROBINSON

Men of the Industry

Changes in Personnel and Position—Biographical Notes

E. G. Robinson has resigned from the management of the Washington Coast Utilities Company, Arlington, Wash., successor to the Jim Creek Water, Light & Power Company, and has purchased the entire stock of the Molalla Electric Company at Canby, Ore., of which he becomes president and general manager. The Molalla Electric Company furnishes electric service to Canby, Barlow, Aurora, Hubbard, and Donald, and operates a water-power plant of 225 kw., located on the Molalla River. Mr. Robinson is a past-president of the Northwest Electric Light & Power Association, and has been very active in association work in the Pacific Northwest. He is a graduate of the electrical engineering course at Leland Stanford University, and after spending four years in electrical and steam engineering work in the Klondike, Yukon Territory, and at Dawson, he returned to Seattle, Wash., later becoming superintendent of the Ballard Electric Company, which had taken over a defunct municipal plant. This plant Mr. Robinson rebuilt and put on a sound financial footing, but resigned his position to become superintendent of the Skagit Improvement Company of Sedro-Woolley, Wash. Eighteen months later he went to Arlington, Wash., as manager and engineer of the Jim Creek Water, Light & Power Company.

L. H. Hartstock, manager of the Pacific Gas & Electric Company's system in Colusa, has resigned to assume the position of assistant manager of the Grass Valley and Nevada interests of the Pacific company.

H. L. Beach, for the past two years general manager of the Utah Light & Power Company, Salt Lake City, has resigned his position and will return to the East. His successor has not yet been named. Mr. Beach is to be associated with the same interests in the East.

A. L. Scott, who has been sales manager for the Edison Electric Illuminating Company at Lebanon, Pa., for several years, has been transferred by the Reading Transit & Light Company to undertake special work for President West. His duties will include those of general sales manager, also.

Charles O. Murphy has been appointed assistant general manager of the American Public Utilities Company, with office at Grand Rapids, Mich.

L. B. Andrus has been appointed chief engineer of the American Public Utilities Company, with headquarters at Grand Rapids, Mich, succeeding B. T. Gifford.

M. B. Wheeler will be appointed commercial agent of the American Public Utilities Company, effective March 1, 1917, with office at Grand Rapids, Mich.

Donald McDonald, manager of the Louisville (Ky.) Gas & Electric Company, was elected vice-president of the Louisville Industrial Foundation at the last annual meeting of the stockholders.

Eben F. Putnam has been appointed superintendent of the Greenwich, Conn., district of the United Electric Light & Water Company. Mr. Putnam was formerly commercial agent for the same company at Waterbury.

W. R. Waggoner, superintendent for the Salina (Kan.) Light, Power & Gas Company, operated by Henry L. Doherty & Company, goes to the Montgomery (Ala.) Light & Water Power Company in a similar capacity.

J. W. Murdock, who has been manager of the Ithaca Gas & Electric Corporation, Ithaca, N. Y., has been appointed general superintendent of the Associated Gas & Electric Company's properties in New York State.

W. A. Schoel of Vancouver, Wash., has been appointed manager of the North Coast Power Company at Chehalis, Wash., to succeed Otto Frank, who resigned to accept a position with the Twin City Auto Company of Chehalis.

G. H. Losey, who was superintendent of maintenance of way of the railway electrical department of the Indiana Railways & Light Company, has been made electrical engineer in charge of the company's railway and lighting department.

W. E. O'Neil, who for the past ten years has been superintendent of the Norwich (N. Y.) Gas & Electric Company, has been appointed superintendent of the Ithaca (N. Y.) Gas & Electric Corporation, succeeding J. W. Murdock, who has been appointed general superintendent of the Associated Gas & Electric Company's properties in New York State. P. R. Chambers, formerly manager of the Manatee Electric Company of Bradentown, Fla., succeeds Mr. O'Neil as superintendent of the Norwich Gas & Electric Company.

C. F. HARDING

Charles Francis Harding, the president-elect of the Indiana Engineering Society, is professor of electrical engineering and director of the engineering laboratory at Purdue University, LaFayette, Ind. Professor Harding is a graduate of Worcester Polytechnic Institute, and after testing work with the General Electric Company at Schenectady became electrical engineer for the Worcester-Southbridge Railway Company. In 1905 he was appointed engineer for the D. & W. Fuse Company at Providence, R. I., and in 1906 he served as assistant professor of electrical engineering at Cornell University. For two years thereafter he was a member of the Stone & Webster electrical engineering staff, responsible for planning and superintending the installation of electrical equipment for many of the electric light and railway companies operated by that corporation. Since coming to Purdue, in March, 1908, Professor Harding has continued in part his appraisal and consulting engineering work, having been called into consultation by various Indiana utility companies. Professor Harding is the author of the standard text-book, "Electric Railway Engineering." He is a Fellow of the A. I. E. E.

H. N. Eastman, of Portsmouth, N. H., has been appointed manager of the commercial department of the Rutland Railway, Light & Power Company.

Obituary

John J. Burleigh, vice-president of the Public Service Corporation of New Jersey, died on Feb. 18, at his home at Merchantville, N. J., a suburb of Camden. He was born in 1855 and was a telegraph operator when fourteen years old. Four years later he was made chief operator of the Pennsylvania Railroad between New York and Philadelphia. Mr. Burleigh built the first telephone system of South Jersey, which in 1880 was sold to the Bell system. He built the first electric street railway in the State at Camden in 1890, and organized the Camden Light & Heating Company, which was taken over by the Public Service Corporation.

REVIEW OF TRADE AND MARKET CONDITIONS

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

LICENSEES UNDER TUNGSTEN INCANDESCENT LAMP PATENT

Fifteen Domestic Manufacturers and Four Importers Have Now Signed Agreements and Paid Back Damages

In accordance with the plan announced late last fall and reported in the Oct. 28 issue of the ELECTRICAL WORLD, a number of independent lamp manufacturers have been licensed under the Just & Hanaman patent, owned by the General Electric Company, to manufacture tungsten incandescent lamps. To date the number of domestic manufacturers that have signed license agreements is fifteen. Four importers of tungsten lamps have also signed licenses. In all cases the licensees have paid back damages for infringement of the patent for all tungsten lamps sold from date of issuance of patent, Feb. 27, 1912. Domestic manufacturers are licensed to continue the manufacture of tungsten incandescent lamps. The importers are licensed to sell only such lamps of foreign manufacture as they now have in stock. This action automatically prevents the further importation of tungsten incandescent lamps.

A number of other manufacturers are seeking licenses, which it is expected will be issued as soon as the necessary details have been satisfactorily arranged. Manufacturers that have signed the tungsten lamp license agreement to date:

Acton Lamp Company, New York, N. Y.
Davis Tungsten Lamp Company, Union Hill, N. J.
Domestic Tungsten Lamp Company, West New York, N. J.
Hygrade Lamp Company, Salem, Mass.
Kentucky Electric Company, Owensboro, Ky.
Lux Manufacturing Company, Hoboken, N. J.
M. & W. Company, Springfield, Mass.
Re-New Lamp Company, Boston, Mass.
Triumph Lamp Works, Union Hill, N. J.
U. S. Incandescent Lamp Company, St. Louis, Mo.
Vacuu-Rite Lamp Company, Chicago, Ill.
V. & D. Electric Company, Franklin, Ohio.
Vosburgh Miniature Lamp Company, West Orange, N. J.
Weehawken (N. J.) Tungsten Lamp Company.
Whitelite Electric Company, New York City.

Importers who have signed the tungsten lamp license agreement to date:

Laco-Philips Company, New York, N. Y.
Morimura Brothers, New York, N. Y.
C. D. Wood Electric Company, New York, N. Y.
Szel Import & Export Company, New York, N. Y.

FREIGHT CONGESTION NOT IMMEDIATELY HURT

Curtailment in Production of Raw Materials, However, Likely to Prove Future Handicap to Industry

Although the present freight congestion and consequent shortage of freight cars is the most acute ever experienced there is little evidence of any added hardships being felt so far by Eastern manufacturers. Freight deliveries are slow and rather uncertain, of course, but they have been in this condition now for the past year.

The real effect of the tie-up, however, will undoubtedly be felt by the electrical manufacturers some months from now. At present they are for the most part well supplied with raw materials, but this freight congestion has so handicapped raw material manufacturers that it is very evident that expected spring and early summer deliveries will be further delayed.

Iron and steel men have been particularly affected. Iron production is now less than capacity by a considerable amount, although there are sufficient orders on hand to run plants to the limit into 1918. Iron and steel plays such an important part in the manufacture of electrical products that it is apparent that the effects of the embargoes, while not now felt, will make a very real impression on the market later.

There are many reasons put forth why the situation has become so serious. One factor is the lack of sufficient bottoms to carry away the vast stores of material now awaiting export at Eastern ports. It is probable, however, that the fundamental cause for the tie-up lies with the manufacturers. Large production has become so necessary that space formerly provided for storage facilities has been cut down with the result that the freight cars in many instances became the only available storage space. This has held up many cars that otherwise would have been rolling.

IMPORTS OF ELECTRICAL MERCHANDISE INTO CUBA

Official Statistics Classified by Year and Products According to the Country in Which They Were Manufactured

Statistics follow showing the relative importance of American-made electrical goods in the Cuban market. During the two years prior to the war it will be noticed American goods led in machinery and wire imports, but were second to Germany in the imports of incandescent lamps. Since the war started, of course, the importation of German goods has fallen off to a large extent. In the other markets the demand for American goods lead other makes.

Articles and Countries Supplying Them	1912-13		1913-14		1914-15	
	Quantity	Value	Quantity	Value	Quantity	Value
	Number		*Number*		*Number*	
Electric lamps:						
Austria	6,915	$2,352	16	$6	14,658	$2,075
Belgium	9,111	2,640	9,350	1,852	.....	.....
France	4,653	615	6,175	715	571	127
Germany	354,720	70,278	513,487	83,527	120,505	29,202
Netherlands	71,729	10,567	28,585	5,492	71,802	14,002
Spain	11,532	2,392	9,255	1,400	4,860	789
United Kingdom	592	229	1,000	450	775	295
United States	255,996	50,937	126,467	25,547	397,665	67,750
Total	715,248	140,010	694,335	118,989	610,836	114,240
	Kilos		*Kilos*		*Kilos*	
Copperwire:						
Austria	277	102	2,365	1,344	2,547	943
Belgium	.....	.....	529	161	2,016	854
France	.....	.....	361	122	331	185
Germany	33,188	12,823	153,212	27,167	784	490
Spain	2,848	65	489	224	.....	.....
United Kingdom	9,087	4,706	20,648	9,057	6,803	3,772
United States	1,030,193	370,885	1,271,315	442,083	764,452	240,837
Total	1,075,593	388,581	1,448,919	480,158	776,933	247,081
Electrical machinery:						
Belgium	.....	.....	.....	.....	22,227	5,178
France	176	211	3,737	1,111	10	11
Germany	41,711	15,877	100,929	21,931	9,535	5,853
Spain	.....	.....	193	168	42	35
United Kingdom	3,177	2,041	14,890	6,277	18,057	6,919
United States	275,177	123,890	230,931	98,273	211,773	89,348
Total	320,241	142,019	350,680	127,760	261,644	107,344

EXPORTS OF COMMERCIAL ELECTRIC VEHICLES GROWING

High Price of Gasoline Abroad and Lack of Gasoline Cars, Owing to War Needs, Help Create Demand for Electrics

Conducted entirely by correspondence, the sale of American-made electric trucks abroad is increasing at a greater rate than domestic sales. From one factory alone, the domestic agency sales of which increased 50 per cent in 1916, as compared with 1915, the sales for export increased by 154 per cent. Although foreign sales are growing faster than domestic sales, there is less effort by far expended in this field than at home. There is no personal representation abroad, the business being conducted by local agents. These agents develop the business, bearing the entire expense of obtaining it, and when orders are received trucks are ordered from the manufacturer. The foreign agent pays on delivery at the dock in New York, the same price and with the same discount, it is understood, as the domestic agent.

It has been noticed that the foreign agent is more aggressive than the domestic agent in selling commercial electrics. To a certain extent, of course, the foreign field naturally lends itself to the sale of electrics. The governments at war have practically commandeered every gasoline car that would run, and have made untiring efforts to buy up all the cars they could in neutral countries. There is, therefore, not only a dearth of gasoline cars, but also what is practically a closed market for them. Also, gasoline abroad has advanced to a much higher price than is to be found in this country, while the vehicle-charging rate abroad is usually lower than that found in the United States. The foreign agent, therefore, can sell on the basis of operating cost.

With the exception of England, the bulk of the foreign sales have been for industrial service. In England, however, the municipalities have purchased a number of trucks. Furthermore, there seems to be a decided tendency in the foreign sales towards the large capacities.

Sales have been heavy in Australia and Africa, and especially so in India. Sales to Canada are light, it is understood, due to the very large duty.

PROPOSED STANDARDIZATION OF APPLIANCE PLUGS

Meeting of Manufacturers Called by Wiring Committee of N. E. L. A. to Discuss Situation Broadly

Standardization of electrical fittings, devices and attachments is in the air. Already considerable has been done on this account by the manufacturers on both their own initiative and that of the trade and central station industry.

One of the latest directions in which this force is working is that of appliance plugs. Appliance manufacturers have been invited by the wiring committee of the N. E. L. A., R. S. Hale, chairman, to attend a meeting at the Engineering Societies Building, New York City, to frankly discuss the matter of standardizing on attachment plugs. Neither prices nor license arrangements will be discussed and no definite action except perhaps to appoint subcommittees.

While the wiring committee understands that in the event of plug standardization many manufacturers will be put to great expense in changing their designs, tools, etc., that it may not be possible to decide at once on the best design, and that there may be or are patents claiming to cover some or all of the possible construction, it is firmly convinced that some time in the future there will be a standard form of connection so that a cord will fit the flat iron of different manufacturers, and also will fit percolators, toasters, etc., of different manufacturers. It believes this development is as sure for the future as the present standardization of the Edison screw base for lamps.

It is expected that as a result of the discussion and interchange of experience practically all of the manufacturers may agree on one or more designs which can be standardized.

CONDITIONS GOOD IN NEW ENGLAND SWITCH FACTORIES

No Appreciable Slackening in Demand for Electrical Products Anticipated Should United States Enter the War

Improvement in the labor situation and better deliveries are features of note in the switch manufacturing field of New England. The release of workers from some of the munition plants, following completion of orders, is benefiting the switch factories, some of which are now operating with nearly their full complement of more contented labor. Twenty per cent better deliveries than two months ago are being guaranteed by one large switch maker and yet few signs of a recession in orders appear among representative concerns. It is the opinion of competent executives that even if this country enters the war, there will be no slackening of the demand for electrical products in any way applicable to general power and lighting uses.

Raw materials are still difficult to obtain in part, notably brass, and some delays in freight service are encountered. Collections are on the whole good with respect to large jobbers, but some small jobbers overstocked their shelves in apprehension of further price increases in the fall and early winter, and consequently are somewhat pressed for ready money. No further increases in prices are in sight at this writing. In some cases the shortage in toolmakers has held back development work, and the scarcity of certain raw materials, notably sheet steel, has somewhat retarded advances in switch-box design, but new products are in sight which will add to the safety features of modern wiring installations as soon as raw materials sufficient for mass production can be procured. Relations with jobbers at this time appear excellent, and the outlook is attractive.

LARGE SALE OF COPPER AT TOP NOTCH PRICES

Trade Surprised That So Much of the Red Metal Was Available for First Half Year Delivery

High prices of copper have brought to light supplies of the red metal that were not known to exist. It had been generally supposed that practically all of the first half copper had been contracted for by consumers. However, it is reliably reported that sales last week totaled between 25,000,000 and 30,000,000 lb., mostly in large lots. Several sales of small lots were reported at prices a cent or two above market quotations.

Buyers are still disinclined to anticipate their needs very far in advance. Most of the buying now is for early summer delivery.

Market quotations on Tuesday for electrolytic were as follows, showing a slight increase over last week: February, 36.25 cents; March, 36.25 cents; second quarter, 34.5 cents; third quarter, 31.5 cents; fourth quarter, 30.25 cents.

NEW YORK METAL MARKET PRICES

	Feb. 13 Selling Price Bid	Feb. 13 Selling Price Asked	Feb. 19 Selling Price Bid	Feb. 19 Selling Price Asked
Copper	£ s d		£ s d	
London standard spot	138 0 0		140 0 0	
Prime Lake	33.00	to 34.00†	35.00	to 35.50†
Electrolytic	34.00	to 35.00†	36.00	to 36.50†
Casting	30.50	to 31.50†	32.50	to 33.50†
Copper wire base	40.50	to 41.50†	41.50	to 42.50†
Lead	8.50		8.50	
Nickel	50.00		50.00	
Sheet zinc, f.o.b. smelter	21.00		21.00	
Spelter, spot	10.42½	to 10.67½†	10.55	to 10.67½†
Tin, straits	53.25†		49.00†	
Aluminum, 98 to 99 per cent.	51.00	to 53.00†	51.00	to 53.00†

OLD METALS

Heavy copper and wire	26.00	to 27.00†	26.00 to 27.50†
Brass, heavy	15.50	to 16.00†	16.00 to 17.00†
Brass, light	12.00	to 13.00†	13.00 to 13.50†
Lead, heavy	7.50	to 7.75†	7.50 to 7.75†
Zinc, scrap	7.50	to 7.75†	7.50 to 7.75†

COPPER EXPORTS

Total tons to Feb. 19 6,434

†Nominal.

NEW APPARATUS AND APPLIANCES

A Record of Latest Developments and Improvements in Manufacturers' Products Used in the Electrical Field

Automatic Temperature Controllers

The Bristol Company, of Waterbury, Conn., has developed a line of automatic temperature controllers for gas and oil fired and electrically heated furnaces.

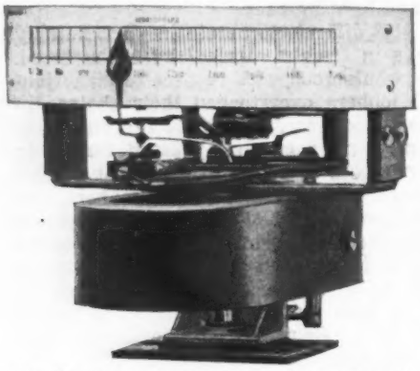


FIG. 1—INTERIOR VIEW OF CONTROLLING ELEMENT OF THERMO-ELECTRIC TYPE

The principle of operation of these temperature controllers is to use three elements: a measuring element, a contacting element and an operating element.

The measuring element consists of a number of different types of Bristol electric pyrometers and thermometers; notably the Bristol thermo-electric pyrometer with Weston millivoltmeter movement and patent Bristol separable couples, also the Bristol vapor-filled type of thermometer, which is very extensively used for recording temperatures. The controlling element is combined with the measuring element and consists primarily of a patented electrical contact closing device, which operates at predetermined high and low temperatures, and by means of this electrical circuits are closed or opened, thus energizing or disconnecting the operating element.

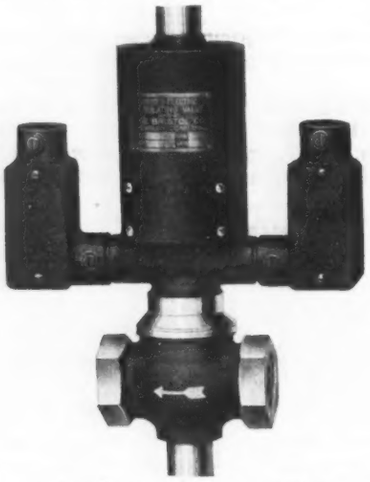


FIG. 2—GAS AND AIR VALVE

The operating element consists of the device which actually regulates the heat supply in the furnace; as for instance, in the case of a gas-fired furnace, a pair of electrically operated gas and air valves, and in the case of an electric furnace it consists of a special relay switch, opening and closing the circuits of the heating element of the furnace.

An interior view of the controlling element of the thermo-electric type is shown in Fig. 1, from which it may be seen that the indicating arm is completely insulated from the operating circuits. The contacting device is absolutely frictionless. These Bristol thermo-electric temperature controllers can be furnished for all temperatures up to 3000 deg. F., and with high-resistance movements for use either with base or precious metal couples.

In Fig. 2 is shown one of the special gas and air valves, two of which are used in connection with gas furnaces if air is supplied at a pressure, and both gas and air valves are operated simultaneously so as to insure having the proper mixture at all times. An interior view of a vapor type Bristol thermometer-thermostat is shown in Fig. 3. Both the high and low contacts are shown in this illustration, but with the Bristol automatic electrical controlling valves for both gas and air supply, only one contact is required.

FIG. 3—INTERIOR VIEW OF VAPOR TYPE THERMOMETER-THERMOSTAT

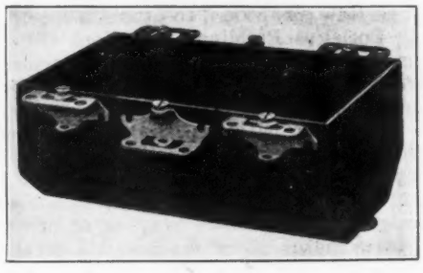
Commutator Cleaner

The Dyno Utilities Manufacturing Company, 608 South Dearborn Street, Chicago, is marketing a commutator cleaner in paste form. This cleaner is put up in tin boxes of 1-oz. size, which are packed in cartons containing six boxes. It is claimed that it will remove all the dirt, oil and grease from a commutator and clear itself from the surface at the same time, leaving nothing on the face of the commutator to increase the contact drop at the brushes. It is therefore offered as a substitute for sand paper as a commutator cleaner. The manufacturer makes the particular claim that this product is not a lubricant, and is not a commutator compound, and contends that modern machines with proper brushes do not require the use of lubricants if they are properly cleaned.

Screwless Switch Boxes

A screwless switch box which the manufacturer, the A. B. Wilson Company of Cleveland, Ohio, claims provides for all the requirements of the contractor's work, is shown in the accompanying illustration. This box can be used for old or new work by reversing the ear from the up to the down position, which provides a correct position of the box. When the ear is up so that the box can be used in old work the lug which holds the switch screw for the other position is bent back with a pair of pliers, thus eliminating the necessity for cutting away any of the fastening-screw space in the wall and leaving a perfect clearance for the box into the opening. The small rivet or burr which holds the ear in position is offset at the two ends so that only one wood screw in each end will lock the ear securely and hold the box rigid.

The boxes may be ganged up to any length with a perfect register of the switches on the plate. The boxes come together and lock securely and there is no wall between to interfere with the passage of the wires from one switch to the next. When the boxes are ganged and placed in position on the wall the holding screws, even if only used in the end boxes, provide against any box in the gang losing its position, but a further safeguard against this is provided in the manner in which the lug of one box passes through the opening in another and makes possible riveting the boxes together at this point by a few taps with a hammer.



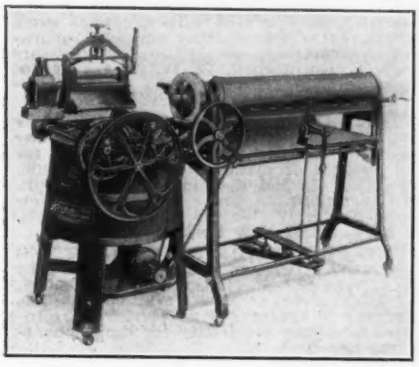
SWITCH BOXES FOR OLD OR NEW WORK

These boxes are sold two ways—

either complete with two side walls, or as spacers only without side walls, this effecting considerable saving when boxes are used in gangs. They are all furnished so that the knockouts are removed from the inside of the box.

Motor-Driven Ironing Machine

The Horton Manufacturing Company of Fort Wayne Ind., has placed on the market a motor-driven, gas-heated, household-type ironing machine, which



HOUSEHOLD TYPE OF IRONING MACHINE

provides an ironing surface 42 in. wide, making the machine capable of handling large pieces as well as small ones. The entire machine occupies a floor space about 5 ft. long by 2 ft. wide and stands about 4 ft. over all, above the floor. The chief features claimed for the machine are that it is noiseless; it is rapid in operation; its ironing surface retains heat; it has a wide space between the ironing shoe and the roll to prevent burning the goods; it is operated by a foot lever; and the tension regulator is conveniently located.

Electric Heating Pad

The pad shown in the accompanying illustration is composed of coils of asbestos-covered wire and equipped with two thermostats which control the heat and keep it at an even temperature. It is covered with eiderdown and is flex-

EIDERDOWN COVERED HEATING PAD

ible, enabling it to be applied to any part of the body. The pad is 9 in. by 12 in., equipped with 10 ft. of cord and a Hubbell attachment plug. The Standard Electrical Appliance Company of Beverly, N. J., is the maker of this appliance.

Oil Drying and Purifying Outfit

Both moisture and impurities, it is claimed, may be effectively and economically removed by passing transformer oil through the oil-drying and purifying outfit shown in the accompanying illustration. In this outfit, the oil to be purified is forced through several layers of specially prepared filter paper. The sediment is strained out by the first layer of paper and moisture is taken up by the capillary action of the paper.

The complete outfit consists of filter press, motor, pump, oil strainer, pressure gage, and piping. The filter press proper is made up of a series of flat cast-iron plates and frames assembled alternately, with the filter papers between them, as shown in Fig. 2. By means of a screw and lever and a movable cast-iron end block, the plates, frames and papers are forced tightly together. Except for a carefully machined rim around the edge, which serves to form a joint to prevent the

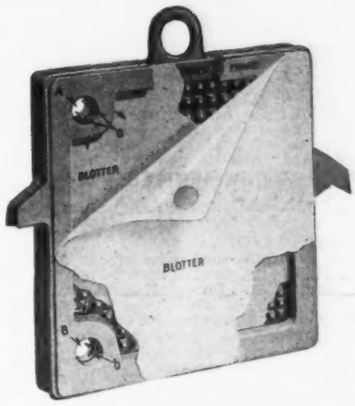


FIG. 2—ASSEMBLY OF ONE FILTER-PRESS PLATE AND ONE FILTER-PRESS FRAME

escape of the oil, the plates are cast with small pyramids on both surfaces.

The plates and frames are cast with holes *A* and *B* in two of the corners. When the plates and frames, with the filter papers between them, are assembled, the holes *A* and *B* form respectively the inlet and outlet for the oil. Cored openings *a* and *b* connect respectively with the holes *A* in the frames and the holes *B* in the plates.

The oil entering under pressure at the top corner through the inlet formed by holes *A* in the frames, plates and filter papers enters by means of the opening *a* in the frames and fills each of the chambers formed between each set of two filter packs. From these chambers there is no outlet opening and the oil is consequently forced through the filter papers that form the sides of the chambers. The filter paper thus takes up all the moisture and screens out all sediment from the oil. After passing through the filter paper, the oil flows along the grooves formed

FIG. 3—ELECTRIC DRYING OVEN, OPEN

by the pyramid surface to the opening *b* in the corner of the plates and thence out through the outlet *B*. The pyramid surface is well adapted for its purpose, it is said, as the tops of the pyramids, being flush with the rim of the plates and spaced close together, support the filter paper against the working pressure, and the grooves readily permit the oil to pass through. This outfit is made by the Westinghouse Electric and Manufacturing Company.

A Westinghouse electric oven for drying the filter paper before use in the filter press is shown in Fig. 3. The oven is substantially built of sheet-iron with double walls. Adjustable slides are provided in the top of the oven for regulating the temperature and the circulation of air through the oven. The filter papers are held in a vertical position in a rack and supported by rods through the holes in the corners of the papers. When the door in the front of the oven is opened, the rack may be withdrawn and the filter paper conveniently inserted or withdrawn. The paper should be dried for about twenty-four hours before being used, but this time can be decreased, depending upon the condition of the paper and degree of heat.

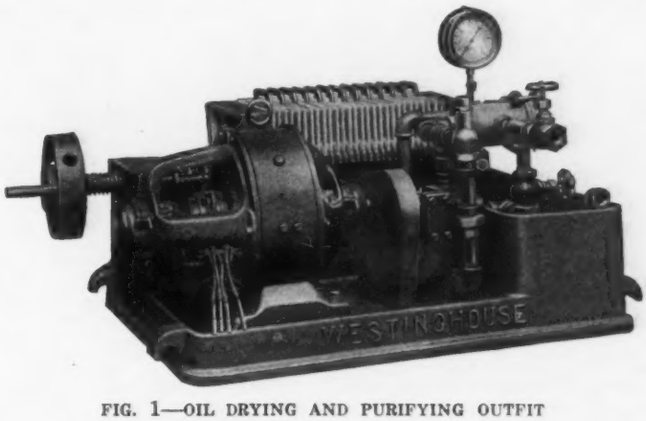


FIG. 1—OIL DRYING AND PURIFYING OUTFIT

Trade Notes

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has just announced the removal of the San Francisco office into a suite of offices in the First National Bank Building of that city. C. E. Heise is district manager. The offices of the Westinghouse Lamp Company are also included.

R. H. HARPER has resigned as general sales manager of the B & K Manufacturing Company and has joined the sales organization of the Western Electric Company at the Philadelphia office.

THE HENRICH REFLECTOR COMPANY, INC., has just moved into new quarters at 142 West Thirty-first Street, New York. This company makes a specialty of corrugated mirror glass reflectors for cove lighting, bank screen lighting, and window and show case lighting.

E. A. GARRETT, who for the past four years has been publicity manager for the Busch-Sulzer Brothers-Diesel Engine Company of St. Louis, has resigned to accept a position with the Boston (Mass.) Belting Company. Prior to his connection with the Diesel Engine Company Mr. Garrett was manager of the Twinplex Sales Company.

PEABODY, RICE & WILSON, electrical engineers, Johannesburg, announce that Philip Herd of Johannesburg, having now entered into partnership with them, they shall henceforth cease to trade under the name of Peabody, Rice & Wilson. The title of the new firm will be: Rice, Wilson & Herd. Mr. Herd has been associated with the South African interests of the British Thomson-Houston Company, Ltd., of Rugby, and the General Electric Company of Schenectady, N. Y.

C. R. MESTON resigned as first vice-president of the Emerson Electric Company at a meeting of the directors held on Feb. 6. He resigned as an officer of the company because he intends to devote his entire time to other business interests. He will remain on the board of directors of the company. The directors re-elected H. L. Parker president. The following were elected vice-presidents: T. M. Meston, L. L. Whittemore, H. I. Finch and E. L. Barkhouse.

WILLIAM J. HAMMER, consulting electrical engineer, announces the removal of his office to 55 Liberty Street, New York City—suite 2510, Liberty Tower Building.

THE HESS-BRIGHT MANUFACTURING COMPANY announces the opening of two branch sales offices—one for the eastern portion of the country at 1974 Broadway, New York, and one for the central section at 1036 Guardian Building, Cleveland, Ohio. H. E. Brunner is in charge of the New York office. The Cleveland office is under the direction of R. E. Clingan.

FARNHAM YARDLEY, son-in-law of the late Alfred B. Jenkins, and formerly vice-president of Jenkins Bros., has been elected president of the company to fill the vacancy caused by the death of Mr. Jenkins. Frank T. Swain, general manager of the company, was elected vice-president. Samuel Laird, manager of the Philadelphia business, has been elected a director to fill the vacancy in the board.

P. & B. MANUFACTURING COMPANY, Milwaukee, Wis., had its main plant destroyed by fire on Feb. 5 with a loss of about $35,000. Arrangements are being made, the company announces, to build a new plant, 80 ft. by 300 ft. The company expects to have the new plant in operation within sixty days.

VAN DORN & DUTTON COMPANY, Cleveland, Ohio, recently moved into its new factory. The main factory building is constructed of two sections, the front section, 50 ft. by 250 ft. and two stories high, and the rear section 80 ft. by 250 ft., built on one floor. At the rear of this section is a large sub-story room which it is intended to incorporate in the next section of the factory to be built. It is the intention of the company to add sections in this manner until the extent of the building has been reached.

UNION METAL MANUFACTURING COMPANY, Canton, Ohio, at its recent annual meeting granted a bonus of approximately 6 per cent of their year's wages to the employees who have been in the service five years or more. In addition to the regular dividend, the company declared an extra cash dividend which represents the largest dividend ever made by the company. The annual report showed a greatly expanded business during 1916.

AMERICAN MANUFACTURERS' AGENCY, INC., has taken the agency for soldering paste, manufactured by the Sieffert Electric Company, Evansville, Ind., and are introducing it to jobbers and dealers.

METAL STATISTICS for 1917, published by the *American Metal Market* and the *Daily Iron and Steel Report* is now ready for distribution. The volume shows output and prices for all the more important metals as far back as authentic records go.

"DELCO" PLANT SALES.—At the annual meeting of the Domestic Engineering Company of Dayton, Ohio, manufacturing the "Delco" lighting system, it was reported that 10,000 "Delco" plants were sold during the year, and that estimated sales for 1917 are 50,000.

WILFRED LUMLEY and HECKERT L. PARKER announce the organization of a new firm, the Conneaut (Ohio) Metal Works. Mr. Lumley leaves the position of general superintendent of the Ivanhoe Metal Works of the General Electric Company to manage the designing and production ends of the new firm. Mr. Parker, who is the business manager for the new firm, has been associated with the electrical industry for fifteen years.

Trade Publications

MOTORS.—"Manager Wise" is the title of a collection of advertisements and data on small motors and their uses recently issued by the Westinghouse Electric & Manufacturing Company as an edition of a publication issued by that company under the title "Small Motors." This pamphlet, which is profusely illustrated, brings out the advantages of small alternating-current and direct-current motors, describing the application and construction of each.

STARTERS.—Auto starters for induction motors embodying the latest developments are thoroughly explained and illustrated in leaflet 1610, just issued by the Westinghouse Electric & Manufacturing Company. The particular features of construction are brought out and illustrated, and a view of the auto starter installed is shown.

CONTROLLERS. — Leaflet 3956, issued by the Westinghouse Electric & Manufacturing Company, covers direct-current magnetic controllers for steel mill and crane service. Uses of this type of controller, together with diagrams of connections and illustrations of the controllers, are given.

RANGES.—The Westinghouse Electric & Manufacturing Company has just issued a number of leaflets, Nos. 3928, 3929, 3932, 3935 and 3942, covering the automatic and non-automatic electric ranges built by this company. The particular features of construction and operation are given, together with photographs showing the range in operation.

RAILWAY ACCESSORIES.—Accessories for use on railways, including circuit-breakers, fuse boxes, resistors, connectors, receptacles and plugs are described and illustrated in Catalog 5-B, just issued by the Westinghouse Electric & Manufacturing Company as a section of its General Supply Catalog. In addition to these accessories, illustrations are also given of the Rico Coasting Time Recorder, which records the actual number of minutes that an electric car or train is operated while coasting, without the use of power or brakes.

PIPE FITTINGS.—The Selah Manufacturing Company of Newark, N. J., is distributing additional leaves Nos. 6, 6A, 7, 10, 11, 11A and 12 and a new price list and discount sheet to supersede those now in the present catalog. These leaves are descriptive of this company's pipe fittings.

SWITCHBOARD.—The Stone Base & Panel Company, Columbus, Ohio, has prepared a leaflet descriptive of its "Stonol," which is a substitute for slate or marble.

MOTORS.—The Universal Motor Company of Oshkosh, Wis., has prepared an attractive calendar. This company makes marine motors and small lighting plants.

FANS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing catalog 8-A, descriptive of its fans for the season of 1917.

FANS.—The Crucet Manufacturing Company, 256 West Twenty-eighth street, New York City, is distributing an illustrated folder descriptive of the Crucet fan stands in period designs suitable for city or country homes.

SWITCHES.—Bulletin No. 45 has been issued by the Detroit (Mich.) Fuse & Manufacturing Company, describing its "Square D" steel inclosed motor starting switches.

New Incorporations

THE ATLANTA ELECTRICAL LEAGUE of Atlanta, Ga., has been incorporated with a capital stock of $5,000 (maximum) by L. L. Shivers, G. Russell and W. R. Collier. The company proposes to conduct electrical shows and exhibitions.

THE ALAMO LIGHT PLANT & BATTERY COMPANY of Bozeman, Mont., has been incorporated by F. G. Roedell of Billings, D. H. Budd of Bozeman and A. F. McCune of Bozeman. The company is capitalized at $25,000 and proposes to manufacture and restore illuminating plants and apparatus for various buildings and equipment, etc.

THE K. & B. ELECTRICAL EQUIPMENT COMPANY of New York, N. Y., has been incorporated with a capital stock of $25,000 to manufacture surgical apparatus, instruments, etc. The incorporators are: L. Kotraschek, W. W. Mowry of Corona, and H. Brodsky, 148 East Sixty-third Street, New York, N. Y.

THE HOLLAND MACHINE COMPANY has filed articles of incorporation under the laws of the State of Delaware for the purpose of manufacturing electric motors and electric machinery of all kinds. The incorporators are: Leonard L. Wetmore, Frank W. Walton and Alexander H. Jackson, all of New York, N. Y.

THE FRIENDSHIP (N. Y.) LIGHTING CORPORATION has been incorporated by M. A. White, J. P. Hopson and G. Wishart, 101 Park Avenue, New York, N. Y. The company is capitalized at $50,000 and proposes to supply electricity for lamps, heaters and motors.

THE BUFFALO ELECTRIC COMPANY of Bellefonte, Pa., has been incorporated with a capital stock of $5,000 to operate in Perry County. A. J. Musser of Clearfield, Pa., is treasurer.

THE LIVERPOOL ELECTRIC COMPANY of Bellefonte, Pa., has been incorporated with a capital stock of $5,000, to operate in Perry County. A. J. Musser of Clearfield is treasurer.

THE LIVERPOOL TOWNSHIP ELECTRIC COMPANY of Bellefonte, Pa., has been granted a charter with a capital stock of $5,000. A. J. Musser of Clearfield is treasurer.

THE SIXTH CITY LIGHT COMPANY of Loraine, Ohio, has been incorporated with a capital stock of $5,000 by Joseph Morgenstein, S. Salz, Aaron Hesnik, A. Lertzman and J. Spielman.

THE KOSSE (TEX.) LIGHT & POWER COMPANY has been incorporated by L. T. Gibbs, W. D. Allen and W. E. Allen, all of Kosse. The company is capitalized at $12,000.

THE LA CENTER (KY.) LIGHT & POWER COMPANY has been organized to operate an electric plant in La Center. S. T. Payne is president.

THE LA CROSSE (IND.) ELECTRIC COMPANY has been organized with a capital stock of $5,000 by Charles Kimble of La Crosse.

THE HEBRON (IND.) LIGHT & SERVICE COMPANY has been incorporated with a capital stock of $25,000 by George W. Giddley, J. F. Cole and George A. Harrop.

THE HARTSVILLE (TENN.) LIGHT & ICE COMPANY has been chartered with a capital stock of $10,000 by C. M. Gwinn, L. T. Littleton and others.

THE CAMBRIA (ILL.) LIGHT, HEAT & POWER COMPANY has been chartered with a capital stock of $2,500 to supply electrical service in Cambria. J. J. Thomas is manager of the company.

THE GEIER MANUFACTURING COMPANY of Cleveland, Ohio, has been incorporated by Ralph W. Edwards, Corinne Altshouse, William J. Coughlin and others. The company is capitalized at $25,000 and proposed to manufacture and deal in electrical appliances.

THE FAIRBANKS STORAGE BATTERY COMPANY of Bridgeport, Conn., has been incorporated with a capital stock of $25,000 to do a general electrical business. The incorporators are: Joseph S. Fairbanks, E. F. Meyer and Thomas P. Thompson, all of Stamford, Conn.

THE ECONOMY APPLIANCE COMPANY of Marlboro, Mass., has been incorporated with a capital stock of $50,000 to manufacture and deal in gas and electrical appliances. The officers are: Benjamin E. Larned, president; Joseph W. Matthews, treasurer, and Thomas A. McAvoy, clerk, all of Worcester, Mass.

New England

CHICOPEE, MASS.—Bids will be received by John C. Gray, superintendent of schools, Chicopee, Mass., until March 6 for erection of high school building, including plumbing, heating and electric work. A deposit of $50 will be required for general plans and $15 for plumbing, heating and electric plans, respectively, which may be obtained at the office of the superintendent of schools.

WHITINSVILLE, MASS. — The Paul Whitin Manufacturing Company has awarded a contract to the Worcester Suburban Electric Company of Uxbridge to install electric lamps in 160 of its tenements.

MIDDLETOWN, CONN.—The Franklin Electric Company has recently purchased property adjoining its plant on Hamlin Street and contemplates extensions which will double the output of the plant.

Middle Atlantic

BINGHAMTON, N. Y.—Plans are being revived for the construction of an electric railway from Binghamton to Utica. Franchises granted in 1907 have been renewed. The plans provide for the construction of a large power plant at Whitney's Point. Thomas McBride of Clinton is interested.

BROOKLYN, N. Y.—Bids will be receied at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 27 for furnishing at the navy yard, Brooklyn, N. Y., telephone switchboards, mechanical telegraphs and telephones. Blank proposals may be obtained upon application to the navy pay office or the above bureau.

GENEVA, N. Y.—The City Council has appointed a committee to make investigations relative to the installation of a municipal electric-light plant in Geneva.

NEWBURGH, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until March 7 for plumbing repairs, conduit and wiring system, lighting fixtures, etc., for the United States Post Office at Newburgh, N. Y. For details see proposal columns.

NEWPORT, N. Y.—The Newport Electric Light & Power Company, it is reported, contemplates extensions to its transmission lines. George T. Woodin is treasurer.

NEW YORK, N. Y.—Bids will be received by Col. J. M. Carson, depot quartermaster, U. S. A., New York City, until Feb. 26 for cable, coils, conduit, electric switches, etc. For further information apply to the above office.

NEW YORK, N. Y.—The property at 77 and 79 Murray Street has recently been purchased by the Interborough Rapid Transit Company, on which will be erected a substation, to be used jointly by the Interborough company and the Brooklyn Rapid Transit Company to supply energy to operate the new subway lines and the present elevated railway lines.

SARANAC LAKE, N. Y.—The Paul Smith Electric Light, Power & Railroad Company has petitioned the Public Service Commission for permission to exercise a franchise to erect and operate an electric distributing system in Jay.

WALDEN, N. Y.—The Wallkill Valley Electric Light & Power Company has petitioned the Public Service Commission for permission to erect electric transmission lines in the towns of Montgomery and Crawford and the exercise of rights and privileges under franchises granted by those towns.

AMBLER, PA.—The Borough Council is considering improvements to the street-lighting system. The present contract expires March 4.

BRADFORD, PA.—The Bradford Electric Light & Power Company has been awarded a contract to install a new lighting system in the business district. Nitrogen-filled lamps of 400 cp. will be used.

MARS, PA.—Bids will be received by the board of school directors, Mars, until March 1 for construction of high school building. Separate bids to be submitted for heating, plumbing and wiring. W. G. Eckles of New Castle is architect.

OSTERBURG, PA.—Notice has been given that application will be made for a charter for the Osterburg Light & Power Company, which proposes to construct a power plant to supply electricity in St. Clairsville, Osterburg, Imler, King, Claysburg, Sarah Furnace, Sprowl and surrounding territory in Bedford and Blair Counties. W. H. Rohm, John H. Zinn and others are interested.

PHILADELPHIA, PA.—The branch line of the Pennsylvania Railroad from Seward to Gallitzin, it is reported, will be equipped for electrical operation, the same system as on the Paoli line to be used.

Construction

News of Projects, Plans, Bids and Contracts. Notes on Work Under Way

PHILADELPHIA, PA.—Charles Christos, 2821 Helen Street, is contemplating the construction of a power plant to operate his new textile mill, to be erected at Hunting Park Avenue and Stockley Street.

WAYNESBORO, PA.—Notice has been given that application will be made to the Public Service Commission soon by the Antrim Township Electric Company, the Guilford Township Electric Company, the Quincy Township Electric Company, the Washington Township Electric Company and the Waynesboro Electric Light & Power Company for a certificate of public convenience and for approval of the commission to merger and consolidate their properties, franchises, etc., into a corporation to be known as the Waynesboro Electric Company.

YORK HAVEN, PA.—The York Haven Water & Power Company is contemplating the construction of a dam across the eastern channel of the Susquehanna River near the present dam to increase the water power facilities.

ABSECON, N. J.—Steps have been taken by local business men to establish an electric-light plant in Absecon. If the contract for lighting the new Absecon-Atlantic City Boulevard can be obtained, it is said, the proposition is assured.

BAYONNE, N. J.—The Public Service Electric Company has acquired a site at Thirty-sixth Street and Broadway on which it will erect a new building, to cost about $75,000.

CLAYTON, N. J.—The local electric-light plant, we are informed, was not purchased by the South Jersey Gas Company, as stated in the issue of Feb. 10. The plant has been purchased by the Electric Company of New Jersey and has been made a part of its system. The general office of the Electric Company is at Pitman. The company is a subsidiary of the American Railways Company of Philadelphia, Pa.

JERSEY CITY, N. J.—Extensive additions will be made to the power plant of the Union Terminal Cold Storage Company on Twelfth Street, and also improvements to the present power station, in connection with the erection of a new eight-story (100 ft. by 100 ft.) cold storage plant. T. Adams is president.

NEWARK, N. J.—The alms committee of the City Council is planning to install new boilers at the power house of the Ivy Hill Alms Institution.

NEWARK, N. J.—The installation of electric-lighting fixtures in the new addition to the City Hospital at once has been recommended by Neil J. Convery, 665 Broad Street, architect. The Council, it is understood, will authorize the work.

NORTH BERGEN, N. J.—Bids will be received by the township committee of North Bergen, Township Hall, Boulevard and Main Street, North Bergen, until March 1 for lighting the streets, fire houses, township hall and public places in the township. Patrick A. Brady is township clerk.

MILFORD, DEL.—Extensions and improvements to the municipal electric-light plant, water-works and sewer system are under consideration by the Board of Light and Water Commissioners.

NEWARK, DEL.—The City Council contemplates extensions and improvements to the municipal electric-lighting plant and water-works system, to cost about $15,000.

OCEAN CITY, MD.—The construction of an electric railway, 10 miles long, is under consideration by the Isle of Wight Land Company. C. Edward is secretary.

RONCEVERTE, W. VA.—The contract for the engineering and construction work in connection of the new steam power plant for the Virginia-Western Power Company of Clifton Forge, Va., has been awarded to the J. G. White Engineering Company of New York, N. Y. Plans for the initial installation provide for 5000 kw. with provision for an ultimate capacity of approximately 30,000 kw. The erection of a short transmission line will connect this new station with the existing transmission lines of the Virginia-Western Power Company, which now operates 114 miles of transmission lines in the territory between Lexington, Va., and Hinton, W. Va.

WASHINGTON, D. C.—Bids will be received at the office of the superintendent, United States Coast and Geodetic Survey, 205 New Jersey Avenue, southeast, Washington, D. C., until March 3 for two electric deck winches for the U. S. Coast and Geodetic Survey steamer Surveyor. For details see proposal columns.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various navy yards and naval stations supplies as follows: F.o.b. works, Schedule 731—7500 or 33,000 lb. rotating copper bands, Brooklyn, N. Y., Schedule 742—40,000 ft. interior communication cable, 4300 ft. galvanized steel conduit, 140 telephone jacks, 21,000 single conductor wire, 20,000 ft. twin conductor wire; Schedule 741—5000 admiralty metal condenser tubes. Philadelphia, Pa., Schedule 742—3000 ft. galvanized steel conduit; Schedule 741—miscellaneous chronium nickel resistance wire; Schedule 729—miscellaneous seamless steel tubing. Boston, Mass., Schedule 742—120,000 ft. insulated antennae wire. Charleston, S. C., Schedule 733—two centrifugal flushing pumps. Mare Island, Cal., Schedule 747—miscellaneous seamless steel tubing. Applications for proposal blanks should designate the schedule desired by number.

North Central

ANN ARBOR, MICH.—Bids will be received at the office of the county clerk of Washtenaw County, addressed to John Lawson, chairman of the building committee, Ann Arbor, until March 8, for construction of a county infirmary, including mechanical equipment, for Washtenaw County. Bids will be taken for the entire work and also on separate contracts. Further information may be obtained upon application to Rupert W. Koch, architect, Ann Arbor.

LOWELL, MICH.—The contract for the engineering work for the new municipal power plant, to replace the one which fell into the river, has been awarded to Gardner S. Williams of Ann Arbor, consulting engineer. The new plant will have an output of 600 kw. and will operate on a 15-ft. head. The contract also includes the rehabilitation of the waterworks system.

MASON, MICH.—The City Council is considering a proposal submitted by the Commonwealth Power, Railway & Light Company of Jackson offering to take over the municipal distribution system and lighting business for $15,000. An election will soon be called to submit to the voters the proposal as to whether the proposition of the Commonwealth company shall be accepted or a new plant installed.

NILES, MICH.—The City Council has authorized the Board of Public Works to purchase an oil engine for the municipal electric-light plant.

PONTIAC, MICH.—Bids will be received by the Board of Education, City Hall, Pontiac, until March 8 for construction of the proposed additions to the High School, the Central School and the Wilson School Buildings. Separate proposal to be submitted for heating and ventilating apparatus and plumbing. Separate bids will be received for electric wiring on additions to the Wilson and Central Schools only. Plans and specifications may be obtained upon application to Perkins, Fellows & Hamilton, architects, 6 North Clark Street, Chicago, Ill., or to Fisher Brothers, architects, Pontiac, upon receipt of $5 for each set of plans for the High School addition and $3 for each set of plans for the Wilson or Central School—$11 for three sets complete, which will be retained by the architects to cover costs.

ALLIANCE, OHIO.—The capital stock of the Alliance Gas & Power Company has been increased from $550,000 to $1,550,000, the proceeds to be used for extensions and improvements to the generating plants and distribution systems.

CLEVELAND, OHIO.—The City Council has adopted a resolution authorizing the Cleveland Railway Company to expend $300,000 for a new substation.

CLEVELAND, OHIO.—The Cleveland Railway Company has awarded contract for construction of a substation at 2162 Ashland Road to the W. I. Thompson & Son Company, 6110 Euclid Avenue, to cost about $60,000.

CLEVELAND OHIO.—Bids will be received at the office of commissioner of purchases and supplies, City Hall, Cleveland, Ohio, until March 6 for cedar poles for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, room 204, new City Hall.

CLEVELAND, OHIO.—Bids will be received at the office of the commissioner of purchases and supplies, City Hall, Cleve-

land, until March 6 for steam boilers and superheaters for the division of light and heat. Specifications may be obtained at the office of the division of light and heat, room 204, new City Hall.

CLEVELAND, OHIO.—The Cleveland Electric Light & Power Company is contemplating rebuilding its distribution lines and also the erection of about 12 miles of transmission lines to supply this and other villages in this vicinity with a 24-hour service. Electricity will also be supplied to residents along the transmission line. W. N. Albertson & Company, First National Bank Building, Milwaukee, are owners of the property.

COLUMBUS, OHIO.—Plans for extensive improvements have been prepared by the Columbus Railway, Power & Light Company, which includes the construction of a large central station on the Hocking Valley Railroad, 6 miles south of the city, to cost about $1,000,000. The proposed work depends upon the consent of the Public Service Commission to the issue of $1,640,379 of new securities. The erection of the proposed station will mean the abandonment of the Third and Spring Street stations. The company has secured 15 acres of land for the station, plans have been completed, and the right of way for the transmission lines has been secured.

LANCASTER, OHIO—The State Legislature has increased the appropration proposed for the Boys' Industrial School at Lancaster from $53,500 to $100,000, to provide funds to build a new power house at the institution.

LEIPSIC, OHIO.—The Northwestern Ohio Light Company is planning to erect a new power plant in Leipsic, to cost about $40,000, on which work will begin soon. Electrical service will be supplied to Hamler and Oakwood from the local plant.

LORAIN, OHIO.—Preparations are being made by the Lorain County Electric Company for the construction of a large electric power plant on the former Baltimore & Ohio property in the rear of the Wickens Company's block. The Lorain company, it is reported, contemplates extending its service to various cities and towns in this section of the state.

MADISONVILLE, OHIO. — Plans are being considered by city officials to abandon the municipal electric-light plant, which is being operated at a loss.

PIQUA, OHIO.—The Bell Telephone Company is planning to remodel an old building for use as its Piqua headquarters, including offices and exchanges, at a cost of about $35,000. Plans are being prepared for placing all wires underground during the year, at a cost of about $135,000.

ST. BERNARD, OHIO.—Plans are being prepared for extensions to the municipal electric power plant, including the installation of new equipment and water softening plant, for which $90,000 in bonds were recently voted. Edgar P. Kay, P. O. Box 151, Cincinnati, Ohio, is engineer. Through error this appeared under St. Bernard, Ala., in the issue of Feb. 17.

TROY, OHIO.—The Dayton Power & Light Company has submitted a proposal to the City Council offering to supply electricity to operate the municipal waterworks system in Troy from its Piqua plant.

YOUNGSTOWN, OHIO.—The Youngstown & Sharon Street Railway Company is contemplating the construction of an electric plant in Youngstown.

MONTICELLO, KY. — The Monticello Electric Light & Power Company has purchased the old mill site and water rights, about 2 miles from Monticello, where it proposes to construct a hydroelectric power plant. Continuous service will be established and flat rates discontinued. Meters will be installed.

BLOOMFIELD, IND.—The Public Service Commission has granted the Indiana Power & Water Company of Bloomfield permission to issue and sell for not less than 80 per cent, par value, $119,000 in capital stock and $569,000 in bonds, for extensions and improvement to its properties.

COLUMBUS, IND.—The city of Columbus has recently purchased a 300-kva. Westinghouse, turbine-driven generator, to cost about $16,000. Not yet installed. J. C. Rush is general manager.

FORT WAYNE, IND.—Improvements, involving an expenditure of about $100,000, are contemplated to the municipal electric-light plant during the coming year, which will include the installation of a 5000-kw. steam turbine, condenser and auxiliary equipment and also a 750-hp. boiler. Underground conduits for electric wires will also be installed in the fire limit district of the city, at a cost of about $15,000. Frank J. Dix is superintendent.

KOKOMO, IND.—The directors of the Indiana Railways & Light Company have approved of an appropriation of $300,000 to be used for extension to street railway system and enlarging power plant in Kokomo.

SOUTH BEND, IND.—The Public Service Company has granted the Farmers & Merchants Light & Power Company of South Bend, recently organized, authority to issue and sell $500,000 in capital stock the proceeds to be used to purchase five water power sites in northern Indiana and to construct and operate electric-light and power plants. The cost of the proposed plants is estimated at $340,139.

BLOOMINGTON, WIS.—The Bloomington Electric Light & Power Company, it is reported, contemplates the installation of a 40-kw. generator and a 60-hp. engine.

JANESVILLE, WIS.—Plans are being prepared by A. Arthur Guilbert, architect, Racine, Wis., for construction of a new factory and power plant for the George S. Parker Pen Company, to cost about $75,000. The main factory will be 75 ft. by 150 ft., two stories, with separate engine and boiler house.

LANCASTER, WIS. — The Lancaster Light & Power Company has been awarded a contract for lighting the streets of the city for a period of five years. The new contract provides for the installation of new lamps.

MILWAUKEE, WIS.—The Electric Steel Casting Company has purchased a site at West Allis and is preparing plans for the first unit of its plant, which provide for the erection of a foundry, power house, pattern shop, laboratory and office building, at a cost of about $100,000. A three-ton electric furnace will be installed in the foundry. Chauncey Yockey of Milwaukee is secretary of the company.

OSCEOLA, WIS.—Plans have been completed for the construction of a hydroelectric power plant for the Osceola Mill & Elevator Company. The plans provide for power house, 2000 lin. ft. of wood stave pipe; also the installation of generator, water wheel to develop 200 hp. under 130-ft. head, switchboard, head works, etc. Bids, it is understood, will soon be asked for. The Power Engineering Company, Corn Exchange, Minneapolis, Minn., has charge of the engineering work.

WHITEWATER, WIS. — Improvements and extensions involving an expenditure of $25,000, it is reported, are contemplated by the Whitewater Electric Light Company during the coming year.

EMMONS, MINN.—Plans are being considered for the installation of a municipal electric-light plant in Emmons. Earl D. Jackson, Capitol Bank Building, St. Paul, Minn., is consulting engineer.

EVELETH, MINN.—The Minnesota Utilities Company, which owns and operates the electric light, power and central steam heating properties serving the communities of Chisholm, Eveleth, Coleraine, Bovey, Taconite, Marble, Calumet, Spina and Kinney, contemplates a water power development to generate electricity for transmission to towns and cities in the Mesaba Range country of Northern Minnesota. Neil Brown, Walter Alexander and others of Wausau, Wis., are interested in the company.

CUMBERLAND, IOWA.—At an election held recently the proposal to issue bonds for the installation of a municipal electric-light plant was carried.

FAIRFIELD, IOWA.—At an election held recently the proposal to grant the Iowa Railway & Light Company of Cedar Rapids a franchise to supply electricity in Fairfield was carried.

GRINNELL, IOWA.—Plans are being prepared by the Pillsbury Engineering Company, Metropolitan Building, Minneapolis, Minn., for an addition to the power plant at Grinnell College. H. W. Somers is secretary and business manager.

MOUNT VERNON, IOWA.—The Wapsie Power & Light Company of Mount Vernon has recently completed 22 miles of 6600-volt transmission lines and will serve the town of West Branch with energy in bulk, and also will furnish electricity to about 50 farmers along the line. The company also contemplates extending its transmission line to Downey, Centerdale and Springdale. Kenneth Lindsay is manager.

OSKALOOSA, IOWA.—Bids will be received at the office of L. T. Shangle, Secretary Board of Education, Oskaloosa, until March 16, for addition to and alterations in the present high school building. Separate bids to be submitted for heating and plumbing and electric wiring. Plans may be obtained at the office of Proudfoot, Bird & Rawson, architects, 810 Hubbell Building, Des Moines, Iowa.

OSKALOOSA, IOWA.—Bids will be received by the general building committee of the Penn College, Oskaloosa, until Feb. 28 for construction of the women's dormitory building, to be located on the new Penn College Campus. Separate bids will also be received at the same time for heating, ventilating and automatic control of the main group building now in course of erection; also for automatic inter-communicating telephone system for the main group building, and clock system, bell and program system; also for vacuum sweeper system for main group building; electric conduit and electric wiring and accessory electrical work, and for plumbing. A deposit of $25 will be required for plans of women's dormitory, and $14 for each set of plans for heating, plumbing and electric wiring. In each case one-half of the amount of the deposit will be retained. A. T. Simmons, First National Bank Building, Bloomington, Ill., is architect.

GRANDVIEW, MO.—The town has voted to grant L. K. Green & Sons of Pleasant Hill a franchise to supply electricity in Grandview for commercial purposes.

JOPLIN, MO.—At an election to be held March 1 the proposal to issue $195,000 in bonds for improvements and extensions to the municipal electric-light plant will be submitted to the voters.

KANSAS CITY, MO.—Plans are being prepared, it is reported, for a new electric generating plant for the Kansas City Light & Power Company. John H. Lucas is president.

MARSHALL, MO.—Plans are being considered for the installation of a municipal electric-light plant in Marshall, to cost about $75,000. Henrici, Kent & Lowry, 222 Commerce Building, Kansas City, Mo., are engineers.

MIDDLETOWN, MO. — The installation of an electric-light plant in Middletown is under consideration. Messrs. Roberts & Clarke of Mexico are reported interested in the project.

ST. LOUIS, MO.—The Public Service Commission has granted the Union Electric, Light & Power Company permission to absorb the Missouri Electric Light & Power Company, which has been operating in St. Louis County and other sections of the State.

CROSBY, N. D.—Bids will be received at the office of the county auditor of Divide County, Crosby, N. D., until March 14 for construction of a court house and jail and sheriff's residence, separate bids to be submitted on vault doors and shutters, cell and jail work, heating apparatus, plumbing and electrical work. Plans and specifications may be seen at the above office and at the office of Buechner & Orth, architects, 500 Shubert Building, St. Paul, Minn.

BRUCE, S. D.—The city of Bruce has recently sold a bond issue of $7,000, the proceeds to be used for the installation of an electric-lighting system.

BLUE RAPIDS, KAN.—The Marshall County Power & Light Company of Blue Rapids is negotiating with the town of Irving, 4½ miles distant, to extend its service there. Benjamin F. Eyer is general manager.

INDEPENDENCE, KAN.—Plans are being considered by the Kansas Gas & Electric Company for the erection of a 10,000-kw. electric plant, to cost about $1,000,000. W. F. Morrow is local manager.

OSAGE CITY, KAN.—The towns of Allen and Admira are contemplating the erection of an electric transmission line to connect with the local municipal electric-light plant for electrical service in those towns.

YATES CENTER, KAN.—The proposal to issue $30,000 in bonds for the installation of a municipal electric-light plant will soon be submitted to the voters.

Southern States

PILOT MOUNTAIN, N. C.—The installation of an electric-light plant and waterworks system in Pilot Mountain is under consideration. C. M. Bernard is interested.

WARSAW, N. C.—The City Council is considering the installation of an electric-light plant, water-works and sewer system, to cost about $30,000.

ATLANTA, GA.—Plans are being prepared by the Georgia Railway & Electric Company of Atlanta for the erection of four new substations, in order to carry more evenly the increased city arc-lamp lighting load. The changes will call for the revision of all of the 38 arc-lamp circuits, which will require new wires and poles, etc.

NORMAN PARK, GA.—The electric-light plant of the Norman Park Institute was recently destroyed by fire. Arrangements, it is reported, have been made for the installation of a new plant at once, to cost about $4,000.

CLARKSVILLE, TENN.—A resolution has been introduced in the City Council providing that application be made by the city

to the State Legislature asking for permission to issue bonds to establish a municipal electric plant in Clarksville. It is proposed to issue $100,000 in bonds. Electrical service is now supplied by the Clarksville Electric Company, which secures energy from the Hopkinsville plant of the Kentucky Public Service Company.

BIRMINGHAM, ALA.—The court has ruled that the city of Birmingham might issue $500,000 in bonds for extensions to the municipal electric-light plant, as authorized by the election last spring.

DUMAS, ARK.—The City Council has awarded the contract for the construction of an electric-light plant to the J. L. V. Grenier Company.

LECOMPTE, LA.—The town of Lecompte has recently appropriated funds for the erection of an electric-light and power plant in connection with the municipal waterworks system. It is proposed to install a 2300-volt 60-cycle, three-phase, alternating-current system with a low tension distribution of 115 volts; about 15 miles of net work will be erected. Bids for construction of plant will be received within the next 30 days. F. Pythais Joseph of Glenmora is consulting engineer.

ARDMORE, OKLA.—At an election held Jan. 30 the proposal to issue $40,000 in bonds for the installation of a new fire-alarm system was carried.

BARTLESVILLE, OKLA. — The Midco Gasoline Company is building a large electric plant to supply electricity for lamps and motors for the oil fields in this section. The cost of the plant and other improvements is estimated at about $2,000,000.

HASKELL, OKLA.—Preparations are being made for the installation of a municipal electric-light plant, for which $20,000 in bonds were recently voted. The equipment will include two 120-hp. engines, two 75-kw. generators, etc. A. H. Jones, Haskell, is engineer.

LAWTON, OKLA.—The Night & Day Oil Company, it is reported, will rebuild its power plant and pumping station, recently destroyed by fire.

LINDSAY, OKLA.—An ordinance has been adopted by the City Council authorizing an issue of $6,000 in bonds, for improvements to the municipal electric-light plant and water-works system.

NORMAN, OKLA.—The local electric-light plant and ice factory has been purchased by the Oklahoma (Okla.) Gas & Electric Company.

STRONG CITY, OKLA.—The contract for the installation of the municipal electric-light plant is reported to have been awarded to Francis Walker.

WAURIKA, OKLA.—The Council has granted M. Griffin O'Neal a franchise to furnish electricity in Waurika for commercial purposes.

ATLANTA, TEX.—The Gulf Public Service Company, recently organized with a capital stock of $125,000, is planning to construct an electric-light plant and waterworks system to supply electrical service and water in Atlanta, Bloomberg, Queen City and Orange. Edward S. Ellis of McAlester, Okla.; J. C. O'Connelly of Port Arthur, and O. C. Oden of Atlanta are interested in the company.

FORT WORTH, TEX.—The contract for the construction of the new county jail building has been awarded to the Taylor Building Company of Fort Worth, at $228,400. The company was also awarded the contract for plumbing, heating and electric wiring of the building, at a total cost of $56,514.

LUBBOCK, TEX.—Bids will be received by the board of directors of the Ponton Sanitarium at Lubbock until March 7, for construction of the Ponton Sanitaroum, to be erected in Lubbock. Separate bids to be submitted on heating apparatus, cooler, electric elevator, kitchen and laundry equipments. A deposit of $25 will be required for general plans and $10 for heating apparatus, electric elevator, etc. Plans and specifications may be obtained at the office of Dr. O. F. Peebler of Lubbock and at the office of Rose & Peterson, Kansas City, Kan.

Pacific States

PORT ORCHARD, WASH.—The Mason County Power Company has applied to the Board of County Commissioners for permission to erect and maintain electric transmission lines to supply electricity in various towns and villages in Kitsap County. The company has a power plant on the North Fork of the Snohomis River, near Hoodsport on Hoods Canal.

RITZVILLE, WASH.—The Pacific Power & Light Company of Portland, Ore., is negotiating with the Commissioners of Adams County for the right of way for electric transmission lines from the southern border of Adams County to Lind.

SEATTLE, WASH.—Bids will be received by the Board of Public Works, Seattle, until March 16 for auxiliary steam plant to be erected as an adjunct to the municipal electric plant at Lake Union. The equipment will cost $300,000 and will double the output of the plant. Bids will be received on the entire installation or on the following units: (1) boiler feed pumps and service pumps; (2) steam turbo-generator, reactance coils, exciter, etc.; (3) high vacuum set condenser, air and water pumps, etc. J. D. Ross is superintendent of lighting.

SEATTLE, WASH.—Announcement has been made by the officials of the Great Northern Railway Company that work on the hydroelectric power project on the Chelan River would begin at once. The plans provide for the installation of a 150,000-hp. plant to operate the company's lines from Spokane to Seattle. It is also proposed to equip the coast lines of the Great Northern Railway between Vancouver, B. C., and Portland, Ore., covering more than 500 miles of railroad, much of it double-tracked. Work will begin this spring on the construction of the dam and power station, the former at the foot of Lake Chelan and the latter on the Chelan River. The power plant will be built in the basalt side hills in the canyon of the Columbia River. The cost of the work is estimated at about $20,000,000.

SEDRO WOOLLEY, WASH.—The City Council is negotiating with the Pacific Northwest Traction Company of Mount Vernon for a new street-lighting contract to cover a period of five years. Considerable changes will be made in the street-lighting system if the contract is made.

SPOKANE, WASH.—A bill has been passed by the State Legislature authorizing the raising of the water along the fort target range for the development of a large power project by the Spokane Valley Power Company.

TACOMA, WASH.—The City Council has authorized H. F. Gronen, city light commissioner, to employ a special engineer to investigate plans for increasing the output of the municipal electric-lighting plant, at a cost of $300,000; also to purchase at once two new lighting-feed panels and equipment for substation switchboards, to cost $17,000.

TACOMA, WASH.—The Washington Irrigation & Development Company, it is stated, will build a hydroelectric plant about 9 miles from Beverly. It is estimated that 500,000 hp. can be developed at a cost of from $25,000,000 to $30,000,000. The company, through its consulting engineer, M. O. Leighton, Washington, D. C., is co-operating with the state and federal government geological surveys in the matter. G. L. Parker is district engineer of the U. S. Geological Survey.

BEND, ORE.—The Bend Water, Light & Power Company contemplates the establishment of an auxiliary pumping station soon, to serve in emergencies, for fire protection, etc.

PORTLAND, ORE.—Bids will be received by the Columbia River Interstate Bridge Commission, Multnomah County Court House, Portland, Ore., until March 6 for furnishing material and installing the roadway lighting system for the Columbia River Interstate Bridge and approaches across the Columbia River, between Portland, Ore., and Vancouver, Wash. Plans and specifications may be obtained at the above office.

PORTLAND, ORE.—Preparations are being made by the Portland Railway, Light & Power Company to supply additional electrical energy to the Southern Pacific Company to operate its trains from Whiteson to Cornvallis. The erection of an electric transmission line from the power station on the Clackamus River to Salem is now under way from Mount Angel, so that it may carry higher voltage, and greater facilities for distribution of power from Salem are being provided. The cost of the work is estimated at between $50,000 and $60,000.

ALTURAS, CAL.—The State Railroad Commission has granted the Alturas Electric Light & Power Company permission to issue $100,000 in bonds.

CHICO, CAL.—Plans and specifications prepared by C. M. Burleson, consulting engineer, 785 Market Street, San Francisco, for a municipal electric-light and power plant will be submitted to the Board of City Trustees and to the Business Men's Association. The data prepared include estimates for a power site on Deer Creek, owned by Dennis Murphy. The cost is estimated at $577,536.

FONTANA, CAL.—The State Railroad Commission has approved an issue of $350,000 in bonds by the Fontana Power Company, recently organized, to develop a water power in the mountains to supply electricity in Fontana and vicinity.

SAN FRANCISCO, CAL.—The Sierra & San Francisco Power Company, 38 Sutter Street, is contemplating extending its transmission lines into Modesto. The cost is estimated at about $36,000.

STOCKTON, CAL.—The Railroad Commission has authorized the Western States Gas & Electric Company to extend its electric transmission and distribution lines in Trinity County to the lines of the Northern California Power Company, near Weaverville; to erect distribution lines in the neighborhood of Junction City, Douglas City, North Fork, Hayfork and territory adjacent thereto to furnish electrical service.

WEAVERVILLE, CAL.—The machine shop and electric plant of the Lagrange Mine, near Weaverville, were recently destroyed by fire, causing a loss of about $10,000.

ANACONDA, MONT.—The City Council has passed a resolution creating a special improvement district for the purpose of lighting the full length of Third Street, using 153 lamps of 80 cp. The cost is estimated at $19,000.

HELENA, MONT.—Extensive improvements are contemplated by the Helena Light & Railway Company this year, involving an expenditure of between $60,000 and $80,000. The work will include the erection of an electric transmission line to the Scratch Gravel district to supply electricity to the various mining companies operating in that section; also rebuilding the upper Broadwater railway and the installation of new ties and heavier rails on the East Helena line and the purchase of several new cars.

COLORADO SPRINGS, COL.—Plans are being prepared for the installation of ornamental lighting system on Pikes Peak Avenue, from Nevada Avenue to the Santa Fé station.

STEAMBOAT SPRINGS, COL.—The Steamboat Service Company is contemplating the erection of a five or ten-ton ice plant to be operated in conjunction with the power plant, work on which will begin about May 1. The company also makes a specialty of storage battery repair work and also of charging batteries. W. L. Carver is manager.

Canada

EDMONTON, ALTA.—The Delta Copper Company, 703 Tegler Block, Edmonton, it is reported, contemplates the construction of an aerial railway, 3½ miles long, and also a power plant at Skeena Crossing, B. C.

DELAWARE, ONT.—The ratepayers have approved a by-law authorizing the installation of a hydroelectric system, to cost about $5,000.

PORT ARTHUR, ONT.—The by-law authorizing an expenditure of $2,500,000 for power development by the Ontario Hydro-Electric Power Commission of Toronto, has been passed by the ratepayers. F. A. Gaby is chief engineer.

WOLESLEY, SASK.—Improvements and extensions, involving an expenditure of $10,000, are contemplated to the municipal electric-light plant.

Miscellaneous

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 3 for furnishing structural steel, boiler punches, watt-hour meters, rheostats, etc. Blanks and further information relating to this circular (No. 1125) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and 614 Whitney-Central Building, New Orleans, La.

PANAMA.—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until March 10 for miscellaneous auxiliary equipment for extension to Gatun hydroelectric station and Gatun substation, including oil switches, cable, conduit fittings, copper lugs, copper bar and rod, current transformers, disconnecting switches, end bells, insulators, potential transformers, fuses and fuse supports, doors and miscellaneous material. Blanks and further information relating to this circular (No. 1124) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and Fort Mason, San Francisco, Cal.

1,215,329. Explosive-Cap Protection; Charles H. Allison, Glendale, Cal. App. filed April 20, 1916. Improvements.

1,215,331. Telephone Toll System; Henry M. Bascom, Brooklyn, N. Y. App. filed Sept. 30, 1915. Controlling a signal by relays responsive to currents of different characteristics both of which relays will be energized to complete the normal signal circuit only when the substation line is grounded in the approved manner.

1,215,348. Telephone and Telegraph Relay or Repeater; John H. Cuntz, Hoboken, N. J. App. filed Aug. 10, 1912. Use third coil insulated from the two others and in circuit with an independent source of current.

1,215,354. Intaglio Printing-Plate and the Method of Making Same; William S. Eaton, Sag Harbor, N. Y. App. filed May 1, 1912. Provide an intaglio printing plate of sufficient thickness composed of a solid homogeneous body of iron or other ferruginous material having a smooth surface and having under surface printing lines therein, formed through electro-deposition.

1,215,360. Automatic Pressure-Regulator for Electric Machines; Max Fuss, Berlin, Germany. App. filed March 21, 1911. For separately excited electrical generators, the exciting dynamo being provided with a variable shunt resistance in its field.

1,215,361. Electrical Potential-Regulator; Max Fuss, Berlin, Germany. App. filed Dec. 3, 1912. Maintain the constancy of the generator voltage under all loads and to generally improve the aforesaid structure.

1,215,365. Cable-Armor; Henry R. Gilson, Baden, Pa. App. filed Oct. 2, 1914. Formed of two helically coiled superposed strips of metal arranged to interlock with each other.

1,215,366. Armored-Cable Connector; Henry R. Gilson, Baden, Pa. App. filed Jan. 28, 1916. Connector for attaching armored cables to electrical fixtures.

1,215,377. Sanitary Telephone Mouthpiece; Ed. M. Jenkins, Italy, Tex. App. filed Jan. 19, 1915. Improvements.

1,215,378. Telephone Exchange System; Lewis H. Johnson, Bloomfield, N. J. App. filed July 29, 1916. System having link circuits which may be employed for indiscriminately interconnecting common battery and magneto or local battery telephone lines terminating at a central office.

1,215,389. Signal-Gauntlet; Francis E. Lauray, Detroit, Mich. App. filed Feb. 28, 1916. Provided with and bodily carries an electric cell, an electric bulb, and a finger controlled circuit.

1,215,393. Trolley-Controlled Apparatus; James F. McElroy, Albany, N. Y. App. filed June 1, 1912. Improvements.

1,215,401. Magnetic Reciprocator for Electric Generators; Elbert R. O'Keeffe, Omaha, Neb. App. filed Oct. 13, 1915. Providing means for longitudinal reciprocation of the commutator and its shaft, to permit uniformity in the wear of the surface of the commutator from the contacting brushes.

1,215,421. Block-Signal System; Robert H. Souder and Howell W. Souder, Tamaqua, Pa. App. filed Nov. 18, 1915. For use on electrically operated street railways or interurban roads, although its application is not limited to such use.

1,215,422. Current-Limiter; Charles H. Spangler, Reading, Pa. App. filed Feb. 4, 1915. Current is automatically interrupted when a determined maximum flow is exceeded.

1,215,423. Current-Limiter; Charles H. Spangler, Reading, Pa. App. filed Aug. 16, 1915. As in a residence where a certain number of lamps or other translating devices have been contracted for.

1,215,425. Plotting-Indicator; Elmer A. Sperry, Brooklyn, N. Y. App. filed Dec. 18, 1914. For use on war vessels to indicate to the plotting room the bearings of the target.

1,215,429. Coil Structure for Electromagnetic Devices; Chester H. Thordarson, Chicago, Ill. App. filed June 30, 1913. Improved means for insulating the several turns of the coil one from the other.

1,215,430. Insulated Terminal for Transformers and the Like; Chester H. Thordarson, Chicago, Ill. App. filed Feb. 10, 1915. Withstand heavy electrical stresses, and which is also so constructed as to withstand mechanical and thermal stresses without danger of breakage.

1,215,432. Process of Producing Articles of Quartz Glass; Otto C. Trautmann, New York, N. Y. App. filed Aug. 10, 1916. Quartz glass tubes.

Record of Electrical Patents

Notes on United States Patents issued on Feb. 13, 1917

1,215,433. Process of Producing Articles of Quartz Glass; Otto C. Trautmann, New Rork, N. Y. App. filed Aug. 10, 1916. Particularly quartz glass vessels.

1,215,437. Electric-Circuit Controller; Theodore Varney, Pittsburgh, Pa. App. filed May 27, 1912. Govern polyphase alternating-current motors.

1,215,453. Starting Mechanism for Automobiles; Charles E. Wilson, Wilkinsburg, Pa. App. filed Jan. 5, 1915. Controlling the operative connection of starting motors to the shafts of internal-combustion engines.

1,215,485. Thermostatic Fire-Alarm; Cesar Joseph Cid, Quebec, Quebec, Canada. App. filed Jan. 28, 1916. Sound a series of alarms for indicating a sudden or excessive rise in temperature.

1,215,487. Telephone System; Henry P. Clausen, Mount Vernon, N. Y. App. filed Sept. 2, 1916. Plurality of telephones are connected to a single subscriber's line circuit.

1,215,491. Fuse or Like Device; Nicholas J. Conrad, Chicago, Ill. App. filed April 19, 1913. Present no live parts which may be touched by an operator, and in which all the metallic parts are inclosed by insulating material.

1,215,492. Switch; Elmer E. Cook, Chicago, Ill. App. filed March 23, 1914. Controlled by a combination lock.

1,215,508. Electromagnetic Device; Charles W. Dunham, Swissvale, Pa. App. filed Sept. 12, 1914. Improvements.

1,215,515. Non-Interference Successive Signal Box; Robert J. Gaskill, Fort Wayne, Ind. App. filed July 3, 1916. Fire-alarm.

1,215,522. Railway Signaling; Henry W. Griffin, New York, N. Y. Opp. filed July 24, 1913. For stretches of single track over which traffic moves in both directions.

1,215,524. Safety Device for Elevators; Edward A. Hanff, Wilkinsburg, Pa. App. filed July 30, 1914. Improvement.

1,215,540. Lightning-Arrester; Ray P. Jackson, Edgewood Park, Pa. App. filed Sept. 6, 1910. Protection of very high-voltage electrical apparatus and circuits.

1,215,549. Electric-Conductor-Insulating Support; John A. Koontz, Jr., Palo Alto, Cal. App. filed July 26, 1916. Series of interconnected units.

1,215,566. Circuit-Controller; Ray H. Manson, Elyria, Ohio. App. filed July 13, 1914. Telephone switchboards.

1,215,590. Electric Switch; Harrison G. Thompson, Glen Ridge, N. J. App. filed Nov. 12, 1909. Automatically open and close an electric circuit under predetermined conditions.

1,215,595. Self-Locking Junction-Box Coupling; Alvin W. Weikert and James Pettibone, Washington, D. C. App. filed Aug. 13, 1915. Improvements.

1,215,604. Automatic Printer; George M. Yorke, New York, N. Y. App. filed April 26, 1915. Receiving apparatus of printing telegraph systems.

1,215,605. Means of Synchronizing Rotary Devices; George M. Yorke, New York, N. Y., and George B. Benjamin, Jersey City, N. J. App. filed Aug. 21, 1915. Synchronous telegraph or signaling systems.

1,215,610. Electric Heating-Pad; Harvey E. Bloomer, Milwaukee, Wis. App. filed Nov. 15, 1915. Thermostatic controller.

1,215,621. Pneumatic Governor; Herbert W. Cheney, Milwaukee, Wis. App. filed April 27, 1910. For fluid pressure systems.

1,215,635. Sintering and Smelting Ore; Arthur S. Dwight, New York, N. Y. App. filed June 15, 1916. Particularly those which are susceptible of a desulfurizing or kindred treatment and a sintering treatment, either simultaneously or successively, and of being subsequently reduced by smelting or a similar operation.

1,215,639. Starting and Stopping Mechanism for Engines; Austin D. Eberly, Spokane, Wash. App. filed March 4, 1916. Automatically start the motor at a predetermined temperature and also stop the same automatically at a predetermined increased temperature.

1,215,658. Signaling System; Richard M. Hopkins, New York, N. Y. App. filed June 28, 1916. Call box type.

1,215,665. Spring Arrangement Especially for Contact Devices; Heinrich Landis, Zug, Switzerland. App. filed April 5, 1915. Quick or jerky motion of an organ may be obtained by means of a slow moving driving organ.

1,215,670. Automatic Railway-Crossing Danger-Signal; Jay B. Linker, Charlotte, N. C. App. filed Feb. 28, 1914. Positively operate to signal persons at the crossing when a train is approaching.

1,215,693. Electric Soldering-Iron; Harry A. Orme, Washington, D. C. App. filed Nov. 20, 1916. Electrical self-feeding soldering iron.

1,215,700. Carbon Electrode and Method of Manufacturing Same; Robert D. Pike, San Francisco, Cal. App. filed March 13, 1916. Lamp black refuse derived from the manufacture of illuminating gas from petroleum.

1,215,701. Fuse-Plug; Clarence D. Platt, Bridgeport, Conn. App. filed July 14, 1914. Clearly indicate a "blown" or "dead" fuse.

1,215,702. Loading Duplex or Multiplex Telephone-Lines; Henning Bernhard, Mathias Pleijel and Axel Herman Olsson, Stockholm, Sweden. App. filed April 27, 1914. Improvements.

1,215,703. Liquid-Heater; Fred Poole, Jewell, Kan. App. filed Feb. 2, 1915. Instantaneous.

1,215,704. Automatic Electric Regulator with Stop-Charge Relay; Harry H. Powell, London, England. App. filed Oct. 9, 1912. For car lighting systems.

1,215,722. Circuit-Protecting Device; Edmund O. Schweitzer and Nicholas J. Conrad, Chicago, Ill. App. filed May 22, 1911. For use upon circuits having very high potential and coming from very high capacity generators.

1,215,734. Telegraph-Call; Charles Spiro, New York, N. Y. App. filed April 6, 1916. Call is automatically transmitted by mechanical means and may be repeated.

1,215,748. Electric Heater; Weeden B. Underwood, Rochester, N. Y. App. filed Dec. 14, 1915. For heating water or other fluids.

1,215,757. Flash-Light; William L. White, Birmingham, Ala. App. filed June 13, 1916. When not in use will automatically become extinguished.

1,215,772. Headlight; Frank Buchanan, Syracuse, N. Y. App. filed April 24, 1911. Efficient means for supporting the electrodes and lamp mechanism of the headlight.

1,215,774. Primary Battery; Edwin F. Callender, Galesburg, Ill. App. filed May 29, 1916. Improvements.

1,215,786. Means for Preventing Sparking in Direct-Current Machines; Alois Fahrmbacher, Charlottenburg, Germany. App. filed Oct. 22, 1912. Improvements.

1,215,787. Means for Preventing Sparking in Direct-Current Machines; Alois Fahrmbacher, Berlin-Charlottenburg, Germany. App. filed Jan. 21, 1915. Obtain a commutating field which is as favorable as possible with a wide range of speed.

1,215,795. Elevator-Signal; Robert H. Gaylord, Pasadena, Cal. App. filed Aug. 12, 1915. Single announcing telephone receiver.

1,215,800. Combination Electric Lock-Switch; Robert O. Hammond, Paterson, N. J. App. filed Jan. 28, 1916. Permit the prompt change in said combination any number of times, if so desired.

1,215,807. Electric-Switch; Edward S. Huff, Detroit, Mich. App. filed Nov. 14, 1914. Not liable to deteriorate.

1,215,813. Combination Piano and Organ-Player Mechanism; Richard S. Irvine, San Francisco, Cal. App. filed Sept. 14, 1915. Electrically controlled contact.

1,215,814. Switch for Automatic Telephone Systems; William Kaisling, Chicago, Ill. App. filed April 27, 1910. Selector or connector switches.

1,215,815. Electric Signaling System; Paul Kaminski, Spandau, and Otto Schneider, Schoneberg, near Berlin, Germany. App. filed June 24, 1913. For range finding.